FEBRUARY 1945 — FIFTY-FIRST YEAR

MACHINERY

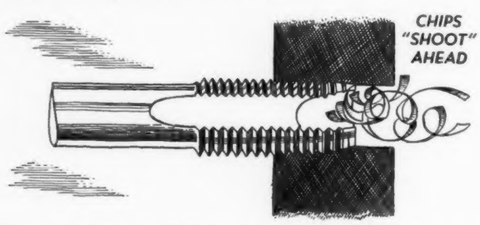
NEW TAP, DEVELOPED FOR BOTTOMING HOLES IN STRINGY MATERIAL, SOLVES OLD PROBLEM

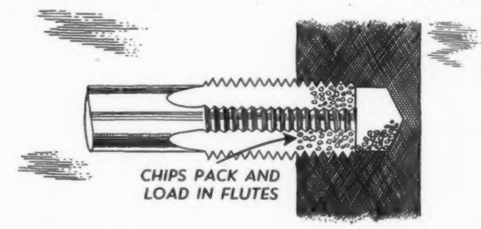
SHOW-HOW

1 On a routine call at an aircraft factory, "Greenfield" distributor's salesman was told—in casual way—that production could be speeded up on a certain job except for traditionally poor performance of ordinary bottoming taps in threading blind holes in stringy materials.

2 Conversation was repeated to "Greenfield Man" in that territory who in turn took it up with "Greenfield" engineers at home office. In spite of fact that this was an accepted limitation of ordinary bottoming taps, "Greenfield" research laboratory tackled this old problem again.

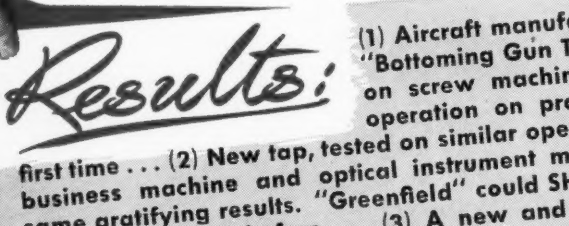
3 Experience showed that "Gun" tap with its clean shearing action was ideal for this material but that cutting angle which gives this shearing action shoots chips ahead of the tap, normally restricts use to through holes or blind holes with plenty of chip room at bottom.

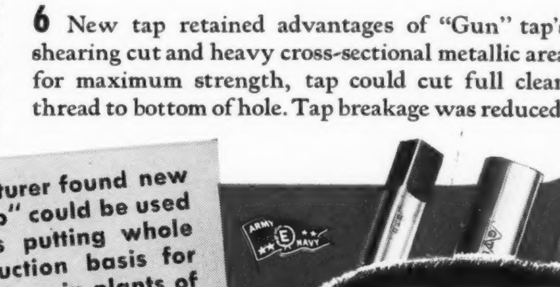




4 Action of ordinary bottoming taps tends to "load" chips in flutes, causing torn threads at bottom of holes when chips pack down; traditionally accepted as unavoidable. These taps are also somewhat more susceptible to breakage because of smaller cross-sectional metallic area than "Gun" taps.

5 "Greenfield" researchers working on theory that "Gun" shearing action combined with chip breaking action would solve this problem; finally developed a cutting angle on a bottoming "Gun" tap which gave desired result. Additional flute space at point of tap provided extra room for chip disposal.





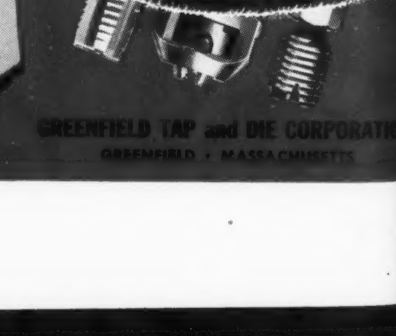
6 New tap retained advantages of "Gun" tap's shearing cut and heavy cross-sectional metallic area for maximum strength, tap could cut full clean thread to bottom of hole. Tap breakage was reduced.

Results:

(1) Aircraft manufacturer found new "Bottoming Gun Tap" could be used on screw machines putting whole operation on production basis for first time . . . (2) New tap, tested on similar operations in plants of business machine and optical instrument manufacturers, gave same gratifying results. "Greenfield" could SHOW HOW problem had been solved before . . . (3) A new and valuable tool was added to "Greenfield's" line.

"Greenfield's" SHOW-HOW is KNOW-HOW in action!

ON THREADING PROBLEMS, CALL YOUR "GREENFIELD MAN" THROUGH YOUR "GREENFIELD" DISTRIBUTOR!



GREENFIELD TAP and DIE CORPORATION
GREENFIELD • MASSACHUSETTS

MACHINERY
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Shrinking and Hardening In One Operation

Practice Followed by the American Car and Foundry Company in the Assembly of Bulldozer Tractor Track Rollers

By CHARLES O. HERB

LARGE economies in time and labor have been effected recently at the Berwick, Pa., plant of the American Car and Foundry Company through a unique application of the Tocco induction hardening process. In this application, two rollers and a hub are assembled together to make up track rollers for the bulldozer tractors that are being produced in this plant for the United States Army.

The assembly is achieved by shrinking the rollers on the hub after they have been expanded by heating them to a high temperature. As the shrinkage occurs, the roller treads and the outside surfaces of the roller flanges are simulta-

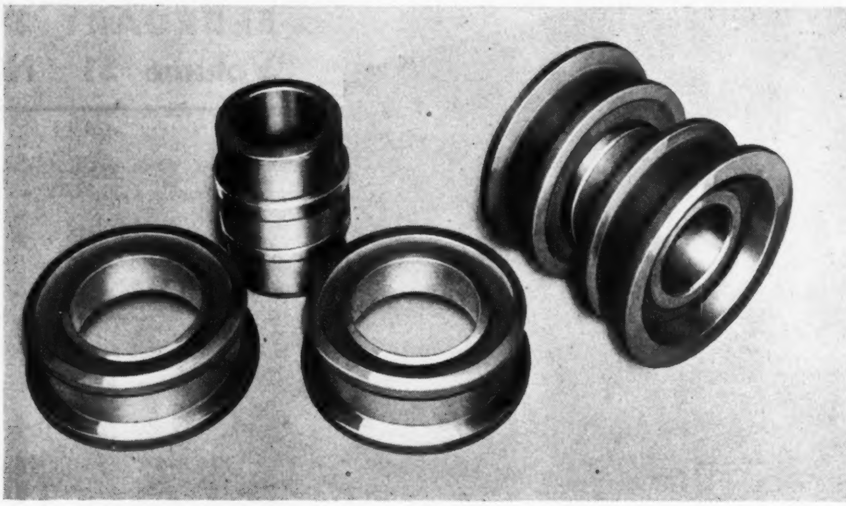


Fig. 1. (Left) The Two Rollers and Hub that Make up the Bulldozer Tractor Track Rollers. (Right) An Assembled Track Roller

neously hardened by a copious water quench, directed on the rollers completely around their circumference.

This practice was adopted because of the manifest advantages that it possessed over the method previously in use. With the Tocco process, the combined assembling and hardening operation is completely automatic, except for loading and unloading the work, and takes an average of only four minutes per assembly.

With the former method there were eight separate steps, all of them performed manually. These steps consisted of (1) placing the rollers in a rotary type furnace; (2) removing the heated rollers from the furnace by means of tongs; (3) placing one heated roller on a hub; (4) quenching that end of the partially assembled unit; (5) removing from quenching bath and turning the unit end for end; (6) seating the second heated roller on the opposite end of the hub; (7) quenching the end of the assembled unit opposite to that already quenched; and

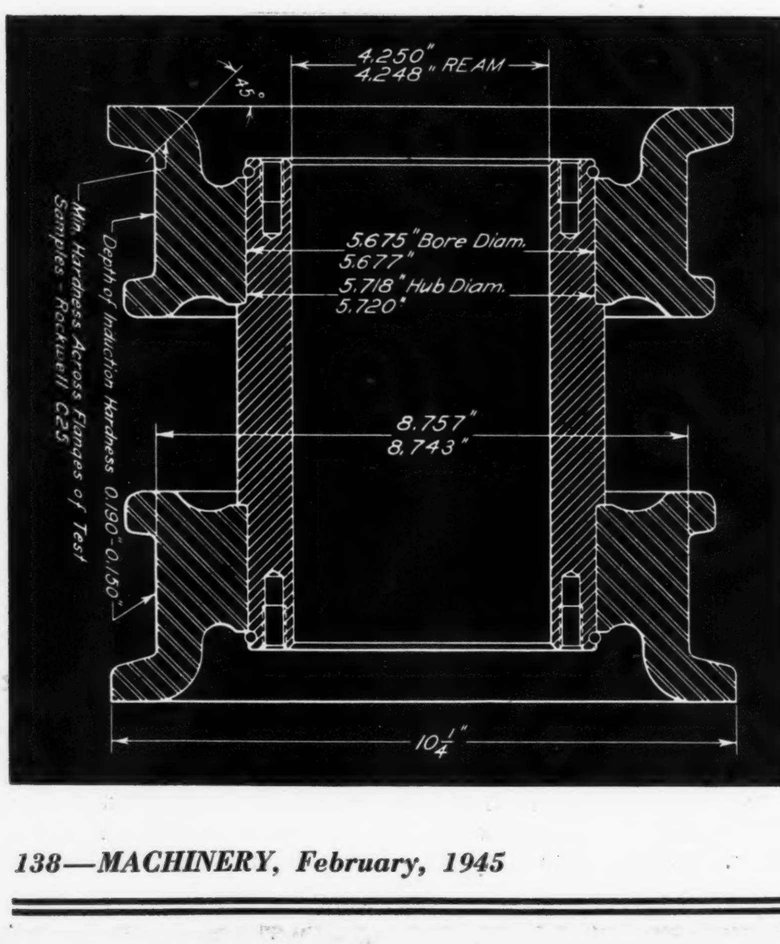


Fig. 2. Cross-sectional Drawing of a Double-flange Track-roller Assembly, which Shows how the Rollers are Mounted on the Hub and Indicates the Size of the Parts

(8) removing the assembled unit from the quenching bath.

One of these track-roller assemblies is shown at the right in Fig. 1, while a group of two rollers and a hub unassembled is seen at the left. Fig. 2 shows an assembly diagram which gives an idea of the size of the parts. In addition to the double-flange rollers here shown, assemblies are also made up with rollers having a flange on the outer side only. The heading illustration shows one of two machines or units installed for assembling and hardening the track rollers by the new process. Each of these machines receives electrical current from two standard 200-kilowatt 3000-cycle Tocco power units, which are operated in parallel from a 440-volt, three-phase, 60-cycle supply line. These power units can be seen along the wall in the background of Fig. 3.

The first step in an assembling operation performed in either machine is to position two rollers on arbors that are located in line with each other on opposite sides of a slide. The space between the ends of the two arbors is somewhat greater than the length of the hub on which the rollers are to be mounted. In the middle of this space and extending toward the rear of the machine, is a fixture for holding the hub during assembly.

The arrangement is clearly seen in Fig. 4, which shows two rollers mounted on their arbors and a hub in position on the fixture. The hub is not placed on the fixture, of course, until after the rollers have been loaded on the arbors. In Fig. 7, one of the arbors is clearly seen without a roller. Spring plungers hold the rollers in place until assembly.

After the rollers have been loaded, the operator pushes a switch button to actuate a mechanism that feeds the arbor slide or carriage about a foot toward the rear of the machine. Here the rollers are carried into inductors constructed of water-cooled copper tubing having a rectangular cross-section. There is one inductor for each roller. From Fig. 5, which shows the rollers in the heating position, it will be seen that the inductors are provided with a central projection that extends almost to the tread of the rollers and with extensions on each side that project over the roller flanges.

Current flows through the side inductors in one direction and through the center inductor in the opposite direction. The amount of the current passing through the two outer inductor loops is equal to that which flows through the center inductor. These inductors are made in a semicircular design, as clearly seen in Fig. 7, so as to cover one-half the circumference of the

Fig. 3. View Showing One of the Tocco Track-roller Shrinking and Hardening Units and a Battery of Tocco Power Units at Rear

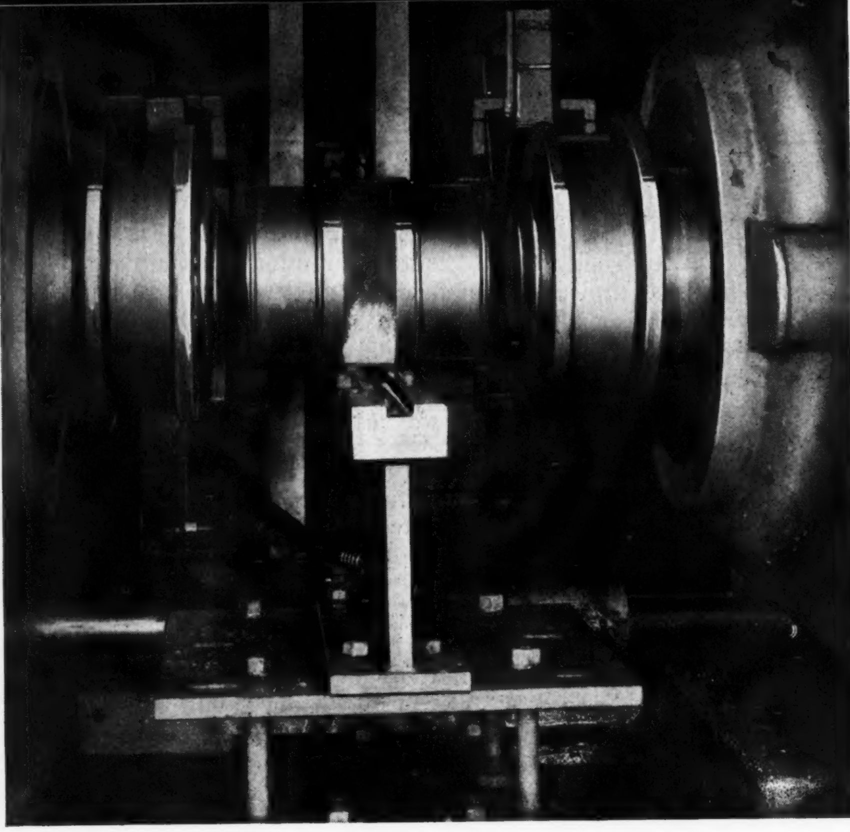
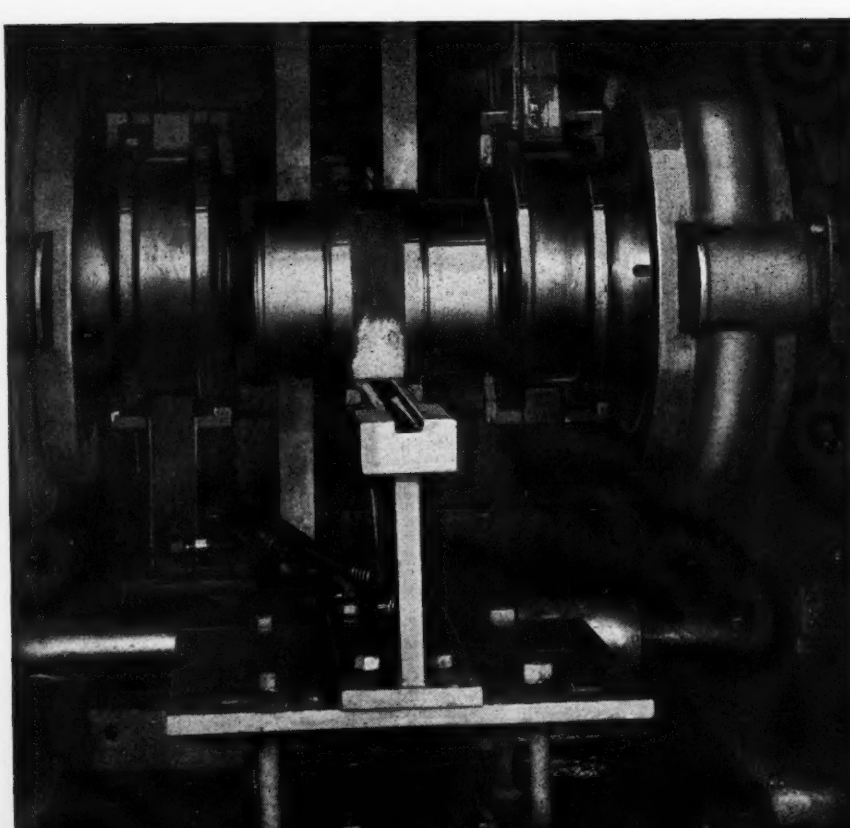


Fig. 4. Close-up View of One of the Assembling and Hardening Machines, Showing the Rollers and Hub at Combined Loading and Quenching Station

Fig. 5. Another Close-up View of the Assembling and Hardening Machine, Showing the Rollers in the Inductors at the Rear of the Machine and a Hub in the Loading Station Ready for Assembly



rollers. The rollers are revolved within the inductors during heating, thus insuring a uniform temperature. The speed of the roller rotation is about 14 R.P.M.

Heating starts as soon as the rollers are moved into the field of the inductors and lasts for 2 1/2 minutes, during which time the rollers attain a temperature of 1650 degrees F. around the rims. The bore of the rollers becomes heated to about 1100 degrees F. by thermal conduction, which creates sufficient expansion to permit the rollers to be easily slipped over the hub. A maximum of 350 kilowatts to a minimum of 280 kilowatts is delivered by the Tocco units.

When the rollers have been heated, the work carriage moves automatically forward to return them to the position shown in Fig. 4. Immediately, the arbor assemblies are fed toward each other to push the expanded rollers on the ends of the hub. A central tapered plug on each arbor enters a corresponding bore in the hub, lifting the hub from the fixture before the rollers are pushed on. This step takes six to ten seconds.

As the rollers are pushed into place, the large housings or quench rings seen in Fig. 6 advance over the rollers and enclose them circumferentially. Water is immediately discharged at a pressure of 35 pounds per square inch through 1186 orifices, spaced around each quench ring. The water is directed around the tread of the rollers and also around the outside flange surfaces. Quenching lasts nineteen seconds, after which the quench rings recede and the arbors withdraw from the ends of the hub.

During assembling and quenching, the rollers continue to revolve, as they did while being heated. Upon the withdrawal of the quench rings, however, the assembly stops and can be conveniently removed from the machine. With a floor-to-floor time of four minutes, the hourly production is fifteen assemblies per machine. At the time of

removal from the machine, the temperature of the rollers has dropped to 350 to 400 degrees F.

When the rollers and hubs are machined, before being brought to the assembling and hardening units, the hubs are turned 0.043 inch larger in diameter than the bore of the rollers. This insures an assembled fit so tight that a force of at least 75,000 pounds is required to pull a roller from its hub. In some tests, a pressure of 110,000 pounds was necessary.

The roller treads and flanges are hardened to about 58 Rockwell C on the external surfaces. The aim is to have a hardness that decreases to not less than 50 Rockwell C at a depth of 1/8 inch. Distortion due to hardening is negligible. The rollers are forged of S A E 1045 steel, and the hubs are made of cast iron.

The movements of the carriage for conveying the rollers from the combined loading and quenching position to the heating position are effected by two hydraulic cylinders on opposite sides of the carriage which apply a water pressure of up to 90 pounds per square inch. These movements are closely controlled by time and limit switches, so correlated that both sides of the slide advance and return together, and not one slide slightly ahead of the other. The arbors are driven from one motor located in the upper area of the machine, which delivers power through chains and a jack-shaft that synchronizes the drives to both arbors. The endwise movements of the arbors and of the quenching rings are also obtained through pressure exerted by water cylinders. All operation controls are devised to provide for manual operation during the setting-up stages and automatic control during production runs.

The reduced manual labor with this practice, as compared with the old method, is apparent, it merely being necessary for the operator to load the rollers and hubs and remove the assembled units. Another important advantage is that the new practice is much cleaner and cooler than the old. During heating and quenching, the front of the machine is closed for the comfort of the operator. Still another advantage is that the operation can be performed by unskilled help.

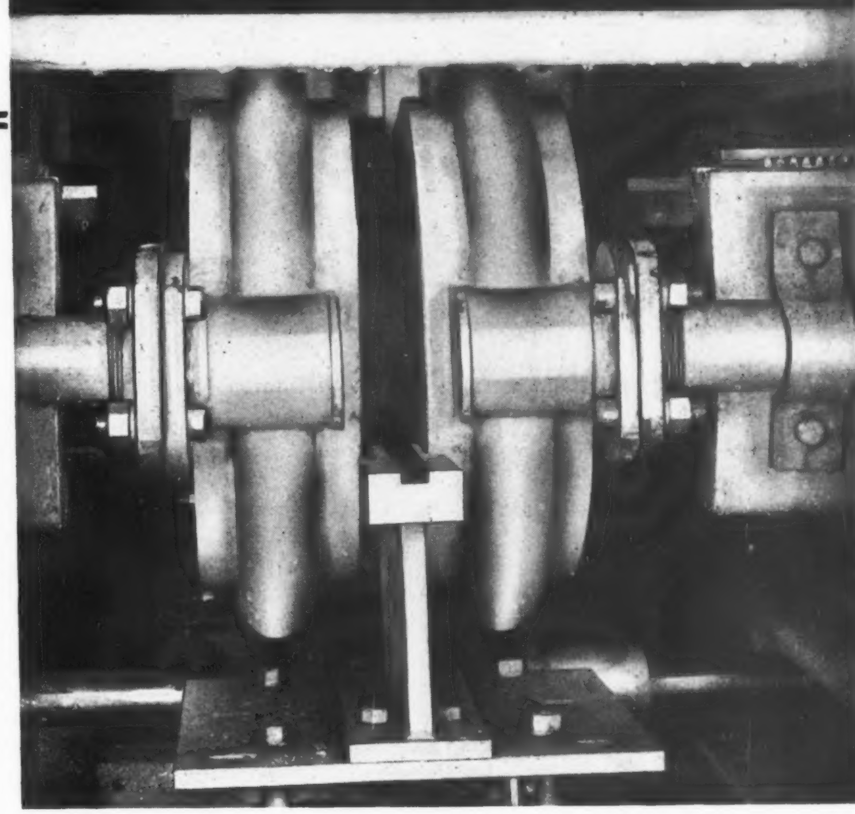
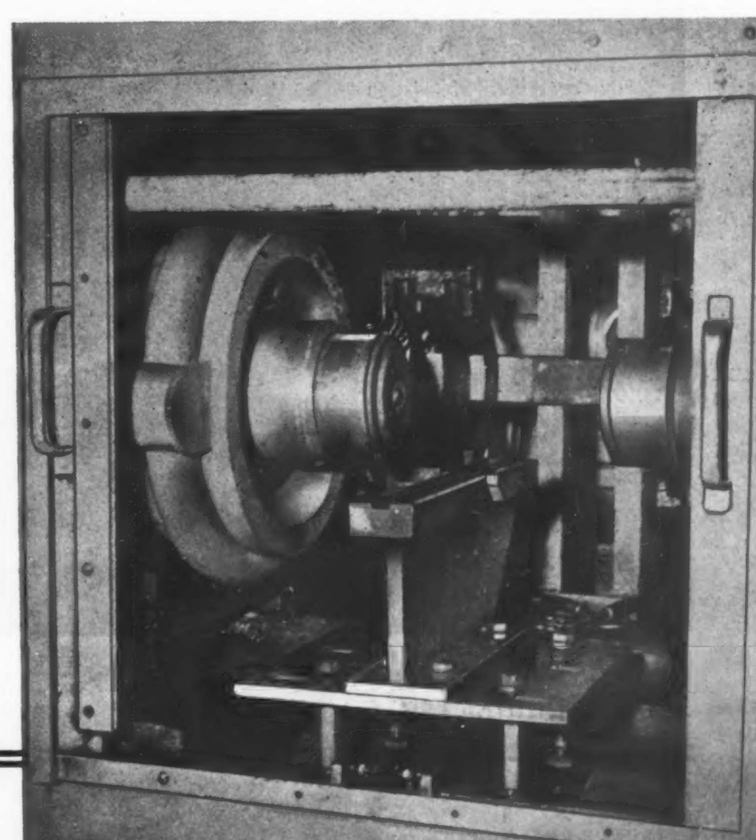


Fig. 6. After the Rollers have been Pushed on the Hub, Large Rings Advance and Cover the Rollers for Quenching Them with Water

Fig. 7. Illustration which Clearly Shows the Construction of the Inductors and the Roller-holding Arbors of the Assembling and Hardening Machine



Press Dies for Punching Mica

By E. H. GIRARDOT
General Electric Co., Schenectady, N. Y.

TROUBLE-FREE performance, with low die maintenance, can be attained in punching natural or fabricated mica, provided proper consideration is given to the inherent characteristics of mica during the design of the dies. Runs of a half million strokes between grinds can be maintained, while some dies have made runs of as high as a million strokes.

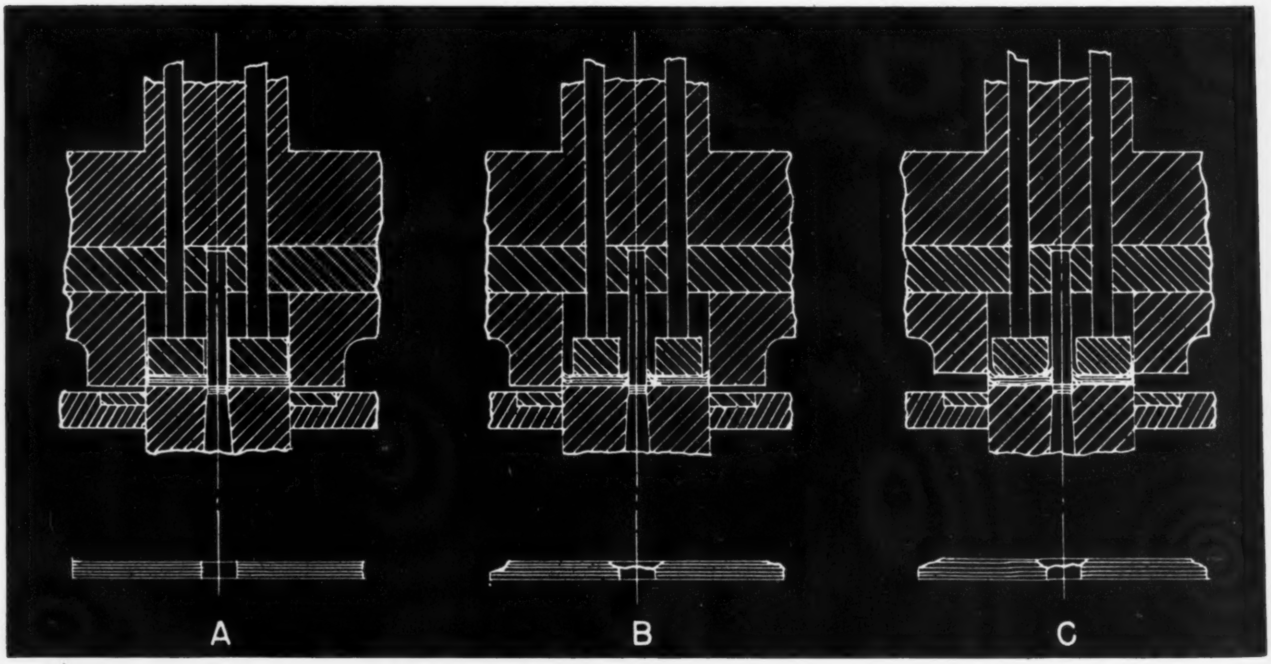
Natural mica—a mineral varying in color and composition—is obtained in sheets. It has a shearing strength of 18,000 to 38,000 pounds per square inch. Both natural and manufactured mica is highly abrasive, and tends to flake, crumble, and powder when worked. These tendencies should be carefully considered in designing dies for punching mica.

Factors that must be given special attention are as follows:

1. Steel for punch and die
   - (a) Kind
   - (b) Resistance to abrasives
   - (c) Surface finish of cutting faces and edges
   - (d) Hardness
2. Strippers
   - (a) Clearance
   - (b) Material
   - (c) Type
3. Pilots and material guides
   - (a) Material and surface finish
4. Punch and die
   - (a) Clearance
5. Die-block
   - (a) Land
   - (b) Clearance angle
   - (c) Solid and sectional
6. Alignment of punch and die
   - (a) Standard rear-post die set (medium production)
   - (b) Center-post or four-post die set (high production)
7. Type of die
   - (a) Compound (natural and fabricated mica)
   - (b) Progressive (fabricated mica only)

The tool steel employed for punches and dies

Fig. 1. (A) Proper Method of Constructing Stripper for Mica Blanking Die. (B) and (C) Improper Methods of Constructing Stripper



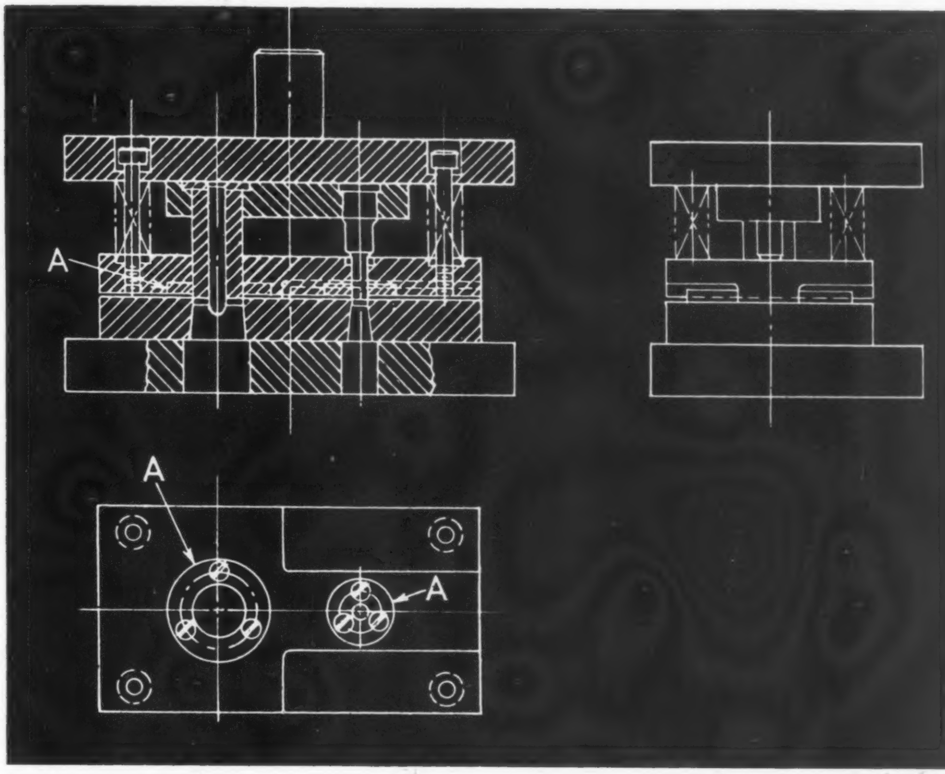


Fig. 2. Spring Type Stripper Made of Machine Steel and Provided with Hardened Tool-steel Inserts around the Punches

used on mica is the most important factor in producing trouble-free, high-production, low-maintenance dies. Diverse types and brands of tool steels having low wearing properties and high abrasive resistance, such as water-hardening carbon steel, oil- and air-hardening die steels, high-carbon, high-chromium, and high-speed steels, were tried with varying success in the plant where the writer is employed. An oil-hardening tool steel with a chemical composition of 0.90 per cent carbon, 0.30 per cent silicon, 0.30 per cent manganese, 1.6 per cent chromium, 0.45 per cent tungsten, and 0.10 per cent vanadium, and with a hardness of 62 to 63 Rockwell C, has proved to be the most satisfactory steel utilized up to the present time for this purpose.

The cutting edges and faces of the punch and die should have a quality of finish (ground and well-polished) that will offer maximum resistance to abrasive wear. The higher the polish or smoothness, the greater the resistance to abrasive action. In resharpening the punch and die, care should be exercised to see that all scores are removed.

To prevent flaking of the mica punching along the cut edges while being removed from a compound die, the die stripper should have a maximum clearance of approximately 5 per cent of the material thickness on a side. The stripper should be made of a good grade of oil- or air-hardening tool steel, and should be hardened, ground, and well polished. It should have sharp edges. The effect of strippers made in this manner is illustrated at *A*, in Fig. 1. The edges of the punching will be true and square, due to the small amount of clearance and the sharp edges of the stripper supporting the punching very close to the cut edges, thereby preventing flaking during its removal from the die.

The effect of increased clearance between the stripper and die is shown at *B*. Inadequate support of the punching close to the cut edges allows flaking during its removal and the top edges of the punching tend to break away. Furthermore, the flakes produced set up an excessive abrasive action between the punch, die, and stripper, reducing the normal die life. They also work up into the cavity between the punch plate and the stripper, and eventually fill this cavity, with resultant damage to the die.

The same undesirable results are obtained, as indicated at *C*, when a soft stripper is used. In this case, the abrasive action rounds off the edges of the stripper, regardless of the amount of clearance, again allowing excessive flaking of the punching.

In the case of progressive dies, used for man-

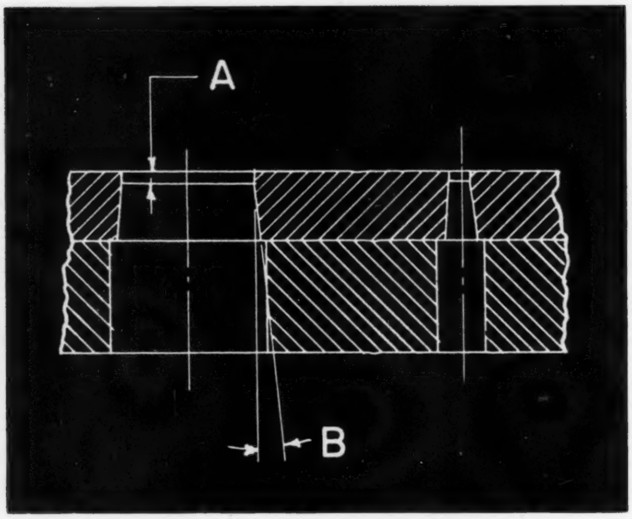


Fig. 3. Diagram Showing how a Mica Blanking Die Should be Provided with a Straight Land and Angular Clearance

ufactured mica only and run in presses equipped with roll feeds, spring type strippers are always utilized. Such strippers hold the material firmly to the face of the die during the entire cutting and stripping cycle. The same relationship of clearance between punch and stripper, and degree of hardness, applies to these spring type strippers as to strippers for compound dies.

Small spring type strippers are made of hardened tool steel. However, because of the warpage and distortion encountered in the hardening of large pieces of tool steel, it is often advantageous to make spring type strippers from machine steel and to utilize hardened tool-steel inserts around the punches, as shown at *A* in Fig. 2. This illustration also shows material guides.

Pilots should be made of a good grade of water- or oil-hardening tool steel and should be hardened, ground, and well polished. They should be replaced when definite signs of abrasive wear are seen. Better results are obtained from pilots having a vertically polished surface instead of a rotary polished surface. Material guides should also be made of a good grade of water- or oil-hardening tool steel, and should be hardened, and the work sides ground. Strippers, stripper inserts, pilots, and guides should be of as high a Rockwell C hardness as is practicable for the particular type or brand of tool steel used.

The clearance between the punch and die should be approximately 4 per cent of the material thickness on a side, this practice having given very satisfactory results. Increased clearance gives a tearing rather than a shearing action and produces a combined residue of fine mica flakes and granules. These will wedge between the sides of the punch and die and cause excessive wear.

A clearance angle is required within the die in all cases where the blank is pushed through the die, as in progressive dies, or where slugs are pushed through, as in both progressive and compound dies. A straight portion or land, 1/16 inch in depth from the cutting edge of the die, as indicated at *A*, Fig. 3, and a clearance angle *B* of 1/2 degree on a side works out very satisfactorily. With this design, slugs and blanks clear the die readily, and maximum die life is insured before the opening in the die has become increased enough in size, through abrasion and successive resharpenings, to result in ragged-edged punchings. No clearance angle is provided in the die-blocks of compound dies, since the punching is not pushed through.

Sectional dies are preferable to solid ones on high-production operations, provided the size and contour of the punching is suitable for such dies. The die sections can be accurately ground and fitted to the contour of the punch, leaving

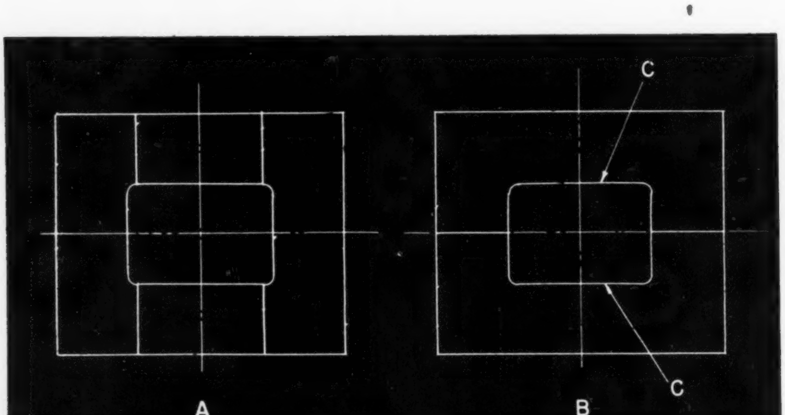


Fig. 4. (A) Correct and (B) Incorrect Lay-outs for Sectional Die-blocks Intended for Performing High-production Punching Operations on Mica

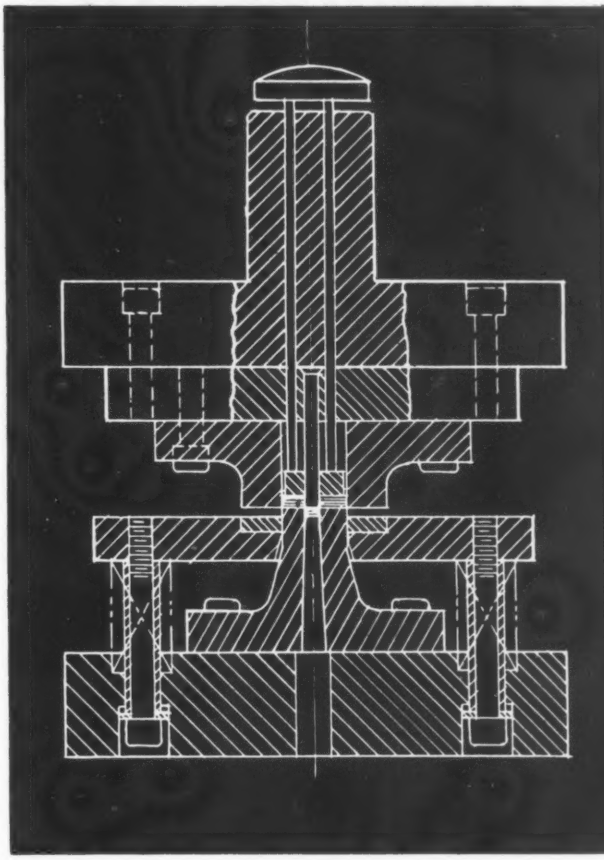


Fig. 5. Compound Mica Blanking and Punching Die which Combines Features Discussed in This Article

the cutting edges and faces readily accessible for polishing and allowing a precision fit to be made between the punch and die.

Proper and improper lay-outs are shown at *A* and *B*, respectively, in Fig. 4, for sectional die-blocks. It will be noted that lay-out *A* lends itself readily to the necessary contour grinding and polishing, and also to repair or replacement in the event of scoring or breakage at any point. One or more sections can be removed and reground and then accurately reset without disturbing the rest of the set-up. In the case of progressive dies, where punchings are pushed through the die, successive resharpenings cause an increase in the clearance between the punch and die. This can be compensated for by removing the sections and refitting them to obtain the proper clearance. In a design such as that illustrated at *B*, refitting to compensate for increased clearance can only be accomplished along edges *C*.

It has been found advantageous to use hardened dowels, as shown at *C* in diagram *A*, Fig. 6, and soft bushings, as at *D*, for doweling the various die sections, rather than to employ the conventional method shown in diagram *B*. Relocation of the die sections is greatly facilitated with this construction, since redoweling becomes only a matter of replacing the soft bushing and then drilling, reaming, and "pinning" from the original dowel-hole in the die-shoe.

The small clearance allowable between the punch and die makes it imperative that die sets be utilized. Standard rear-post sets are satisfactory for low to medium production runs, but it is recommended that the more accurate center-post or four-post sets be used for intricate work or high-production operations.

The compound die shown in Fig. 5 and the progressive die in Fig. 2 illustrate the piercing and blanking of a washer and incorporate the various die features discussed in this article.

No lubricant of any kind should be used in punching mica. A low-pressure air blast can be utilized for removing the flakes and powder from the dies. In such cases, an adequate exhaust is needed to carry off the mica particles.

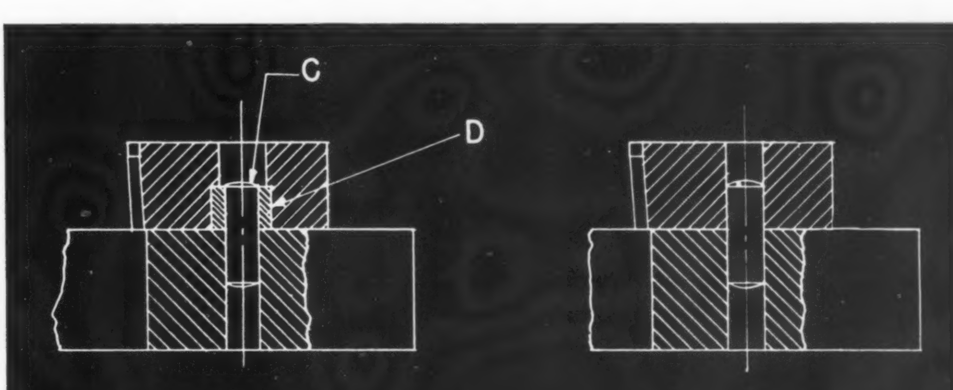


Fig. 6. Hardened Dowels Used in Combination with Soft Bushings as at A, Provide Advantages over the Conventional Doweling Method at B

Magnesium Alloys and Their

Characteristics and Properties of the Various Compositions Available Commercially, and Factors to be Considered in the Fabrication of Parts from Alloys of This Type

MAGNESIUM alloys have a lower specific gravity than any other available structural metals, which, under certain conditions, affords opportunities for weight saving. This is, of course, especially important in aircraft design. Other advantages accrue from the fact that magnesium is an easy metal to machine and has good welding characteristics.

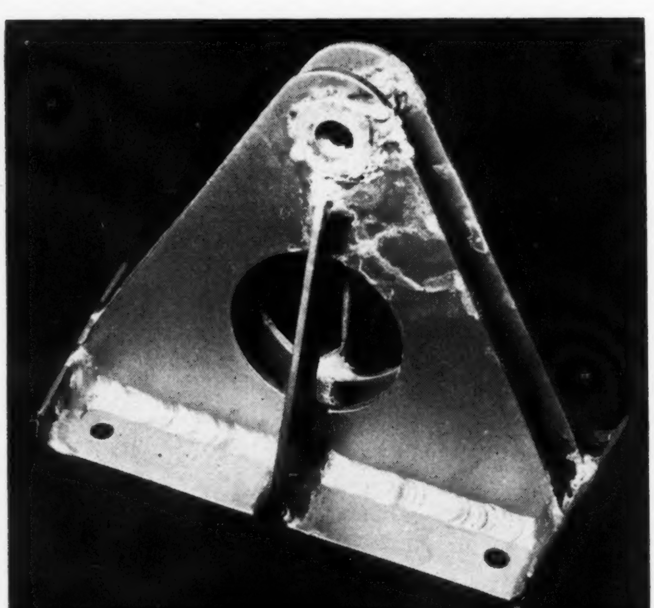
On a pure tensile or compressive strength-weight basis, magnesium alloys do not differ greatly from aluminum alloys. In fact, they are inferior to several of the newer aluminum alloys, particularly those that are aged after heat-treatment, and especially with regard to compressive yield. From a structural stability point of view, however, magnesium alloys can frequently be used to great advantage. The modulus of elasticity and specific gravity are both approximately two-thirds those of aluminum alloys. This means that sheets or beams of magnesium alloy of the same weight as sheets and beams of aluminum alloy will be approximately 50 per cent thicker, their moment of inertia will be 238 per cent greater, and their stiffness 125 per cent greater. It is, therefore, possible to obtain more stiffness with less weight by using magnesium alloys.

This factor offers advantages in sheet covering, in compression members where crippling strength is determined by stability, in long columns, and in beams where space limitations allow depths to be increased. Likewise, one of the most important weight savings resulting from the low specific gravity occurs in applications where minimum sizes are already being used and strength is more than adequate. This factor appears in such applications as non-structural castings, forgings, and fillers.

Some Disadvantages of Magnesium Alloys

There are, however, disadvantages of magnesium alloys, which should be kept in mind, so that these alloys will not be used under unsuit-

Fig. 1. (Left) Welded Fitting of J-1 Magnesium Alloy with Inserted Zinc-plated Steel Bushings, which Shows Considerable Deterioration after having been Subjected to 300 Hours of Salt Spray. Fig. 2. (Right) Torch-welded Duct of Magnesium Alloy. Butt Welds and Shallow Flanges Prevent Buckling along the Welds



Application

By D. A. TOOLEY, Process Development Design Engineer, Consolidated Vultee Aircraft Corporation, Fort Worth, Tex.

able conditions. Several of these disadvantages are as follows:

(A). Owing to their susceptibility to corrosion, particularly when dissimilar metals are in contact with corrosive atmospheres, or when strains exist in a structure, it is ordinarily necessary to finish magnesium alloys carefully with protective paint coatings. This may considerably reduce weight savings obtained by the substitution of magnesium for other metals, especially in the thinner gages. The effect of extremely corrosive conditions on dissimilar metals in contact with magnesium alloy is indicated in Fig. 1 which shows a welded magnesium-alloy fitting with zinc-plated steel bushing inserts which was carefully protected with paint and subjected to an accelerated test in a standard salt spray for 300 hours. Excessive corrosion in the vicinity of the inserts is evident in the photograph.

(B). Formability of magnesium at room temperature is limited. While forming operations at elevated temperatures are simple, few shops have had experience with heated tools, and others are likely to have difficulty in familiarizing inexperienced personnel with hot-working processes.

(C). The ratio of yield strength to ultimate strength is low, compared with aluminum alloys. With most magnesium alloys, the compression yield strength is not more than two-thirds the tensile yield strength. With aged aluminum alloys, compressive yield strength as high as 90 per cent of the ultimate tensile strength and 100 per cent of tension yield strength is obtainable. Therefore, short columns in compression are likely to be relatively inefficient.

(D). With few exceptions, high strength cannot be obtained from annealed, easily worked material by heat-treatment, cold-working being required to raise the strength and yield point.

(E). Magnesium alloys cannot be used under as high temperatures as aluminum alloys. Most magnesium alloys are partially annealed by continuous exposure to the comparatively low temperatures of 200 to 300 degrees F. At temperatures of 600 to 700 degrees F., the strength of the material drops to very low values and complete annealing results.

(F). Magnesium alloys have poor abrasion resistance, and should not be used in applications where they are subject to a large amount of wear.

(G). When hit by solid projectiles, magnesium-alloy structures are superior to structures of aluminum alloy, because holes are sheared out clean rather than flowering and tearing. However, magnesium alloys have a tendency to disintegrate under the influence of explosive ammunition.

Characteristics of Most Common Magnesium Alloys

Unfortunately, much confusion is caused by the fact that commercial magnesium alloys are designated by two entirely different systems. One is in use by the American Magnesium Corporation, the other by the Dow Chemical Co. and most other fabricators of magnesium products. In discussing the different alloys, the practice of a Government-sponsored agency will be followed in using the Dow Chemical designations. The equivalent American Magnesium designations will appear in parentheses. It should be noted that "-1" in Dow designations and "C" in American Magnesium designations indicate a high-purity alloy with low iron and nickel content.

A list of alloys in most common use in different forms and their characteristics follows:

(A). *Sheets*—All alloys mentioned are available in either the hard-rolled or the annealed condition. In sheets thicker than 1/4 inch, hot-rolled temper, intermediate between hard-rolled and annealed, is substituted for the hard-rolled temper.

M(AM3S) is the cheapest and most easily rolled magnesium alloy. Its strength is low, but it has good forming characteristics. It is least affected by elevated temperatures, and is not susceptible to stress corrosion. It has good welding characteristics, particularly with the torch. It is recommended for non-structural applications, such as tanks, ducts, etc.

FS-1(AMC52S) is slightly more expensive and more difficult to roll than M alloy, and its forming characteristics are about equal. Its typical strength is nearly as high as that obtained in any magnesium-alloy sheet, but the guaranteed values are lower than those of J-1. It is tougher than the other magnesium-sheet alloys, and has the lowest critical temperature. It is susceptible to stress corrosion, but not so much as J-1. Its weldability is limited. This alloy is regarded as the best all-around magnesium-sheet alloy for structural purposes.

J-1 (AMC57S) has the highest guaranteed strength properties of the magnesium-sheet

alloys, but it is the most expensive and hardest to roll. Its weldability is good, particularly with the helium arc. It is not recommended in thin gages because of brittleness. This alloy possesses limited formability, and is susceptible to stress corrosion resulting from built-in strains. It is recommended for welded structural assemblies fabricated of heavy materials.

(B). *Extrusions—M(AM3S)* is the easiest magnesium alloy to extrude and, therefore, can be obtained in intricate shapes, such as hollow sections, etc. It has arc-welding characteristics inferior to other magnesium alloys, but can be welded with a torch. Its low elongation prevents wide application, particularly if cold-forming is required.

FS-1 (AMC52S) is slightly more difficult to extrude than M(AM3S), but has better mechanical properties and good elongation. It can be formed cold in many applications, and can be welded by the helium arc process.

J-1(AMC57S) is difficult to extrude, but has slightly better mechanical properties than FS-1. It can be welded with the helium arc. However, due to difficulty in extruding, the use of FS-1 or O-1 is recommended.

O-1(AMC58S) is the only commercial magnesium alloy whose properties can be improved by heat-treatment. It is available in the "as fabricated," aged, and heat-treated and aged conditions. In the aged condition, the compressive yield strength is increased considerably, but it remains somewhat less than the tensile yield strength. The best physical properties are obtained in the heat-treated and aged condition, with a compressive yield strength approximately equal to the tensile yield strength. This alloy should normally be purchased in one of the aged conditions. It is difficult to extrude, but has excellent strength characteristics, and can be welded with the helium arc.

(C). *Castings—H(AM265)* is a magnesium alloy that is available in the "as cast" condition, in the heat-treated condition with slightly better strength, and in the heat-treated and aged condition with the highest strength, but with low elongation. The weldability of this alloy is limited. It is the most commonly used general-purpose alloy for sand castings.

C(AM260) is also available in the "as cast," heat-treated, and heat-treated and aged conditions. This alloy is used for permanent-mold castings and when maximum strength and pressure tightness are required.

M(AM403) is a low-strength weldable alloy. It should be used for fittings to be welded to M-alloy sheet assemblies.

(D). *Forgings—J-1(AMC57S)* is suitable for press forgings of moderate strength.

O-1(AMC58S) is the highest strength magnesium alloy suitable for press forgings. It is available in "as forged," aged, and heat-treated and aged conditions. The yield strength is increased by aging. There is not much improvement from heat-treating, but the "creep" properties are said to be improved. This alloy is weldable.

AM65S is an alloy made by the American

Fig. 3. Electrical Box Drawn from Sheet Magnesium Alloy. Attention is Called Particularly to the Comparatively Sharp Corners that can be Obtained when an Alloy of Favorable Characteristics is Selected and Proper Precautions Taken in the Drawing Operation

Magnesium Corporation for which there is no equivalent Dowmetal alloy. Dowmetal M, however, has similar characteristics but slightly lower strength. These alloys have low strength, but can be hammer-forged, generally, in dies that were designed for aluminum alloys. They are recommended as a substitute for aluminum-alloy forgings whose weight is determined by minimum size and not by strength.

Forming of Magnesium Alloys

Only mild forming of magnesium alloys in the hard condition is possible at room temperature. Sheets in the annealed condition and extrusions in the "as extruded" condition can be formed, but not severely. Most forming of the hard materials at elevated temperatures is limited to 300 to 400 degrees F. to minimize annealing. In the annealed condition, temperatures as high as 700 degrees F. may be used. Most magnesium parts in shapes commonly made of aluminum alloy can be formed at some elevated temperature, but this temperature is frequently so high as to make it impossible to obtain parts of high strength, because high strength is not obtainable by heat-treating after annealing.

Heating of magnesium for forming has been accomplished successfully by the use of gas flames, electrical resistance heating, hot-air heating, dipping in hot oil, etc. Parts should be formed perfectly on the form block, because heat must ordinarily be applied a second time if the parts are finished later by hand operations, as is common practice with aluminum alloys. Surface scratches and imperfections may produce cracks during forming operations.

Bending Magnesium-Alloy Sheet

Minimum bend radii for magnesium alloys are available from numerous sources. In the accompanying table are listed minimum radii which are sufficiently generous for use without difficulty from cracking. In this table, *t* represents the sheet thickness. The maximum temperatures given for the hard-rolled sheet are the highest that it is considered advisable to use, and should be employed for a limited time only, as high temperatures are likely to result in a serious amount of annealing. The highest temperature considered, even for annealed sheet, is 400 degrees F. because that is the limiting temperature for rubber forming. The most successful bends in magnesium sheets are made on hydraulic presses, with the entire sheet heated to a uniform temperature. It is practical to bend small pieces with heated brake dies, although difficulty sometimes results in using this method on large sheets because of uneven temperatures. Expansion of heated edges is prevented by cold portions, with the result that warping may occur when a heated portion cools.

Minimum Bend Radii for Magnesium Alloys

Material	Room Temperature	Elevated Temperature*
Ma (AM3SO)	5*t*	3*t*
Mh (AM3SH)	12*t*	4 1/2*t*
FS-la (AMC52SO) .	3 1/2*t*	1 1/2*t*†
FS-lh (AMC52SH)	10*t*	4*t*
J-la (AMC57SO) ..	7*t*	4 1/2*t*
J-lh (AMC57SH) .	18*t*	4 1/2*t*

*300 degrees F. for FS-lh; 400 degrees F. for all others.
†For values of 0.050 inch and under. Use 2*t* for 0.051 inch and over.

Drawing Sheet Magnesium Alloys

Sheet magnesium alloys lend themselves exceptionally well to drawing operations at elevated temperatures. A slow, uniform operation, such as that obtainable with hydraulic presses, is recommended. Since the majority of drawing operations require considerable time, the usual practice is to heat the draw-ring and blank-holder to keep the material at its proper temperature during the drawing operation.

Draws deeper than those ordinarily made with aluminum alloys are quite common. They are successful because the variation in temperature in different parts of the piece being formed can be used to advantage. For example, the punch is ordinarily not heated, in which case it chills the sides of the part being drawn and increases the tensile strength at the point where failures ordinarily occur in drawing. Fig. 3 shows a drawn electrical box with sharp corners that were produced without difficulty because of this advantage.

Rubber Forming of Magnesium-Alloy Sheet

Hydraulic press pads have been developed capable of resisting temperatures as high as 400 degrees F. This is probably the upper temperature limit practicable, because even at this temperature the life of the rubber may be quite short if used for severe forming. Temperatures of 300 to 400 degrees F. are used for hard-rolled sheets, depending upon the critical temperature of the alloy being formed. It has been found convenient to place an electrically heated metal

platform with automatic temperature controls on the bed of the press in order to hold the die temperatures constant. Thin sheets are most easily heated by placing the cold blank on the heated dies. When thicker material is used, time is saved by preheating the sheet. Aluminum alloy, Kirksite, and magnesium alloy are recommended for die materials, because they have approximately the same thermal expansion coefficient as the material being formed. When steel dies are used, expansion differences between the die and the formed part must be considered. Some material such as powdered or flake mica will prevent forming rubber from adhering to the heated blanks and tools.

Shrinking operations in the hydraulic press are limited. In many cases where the work has curved shrink flanges or joggled flanges, it may be necessary to change the shape of the flat portion of the part by the use of blisters or cutouts in the die to eliminate wrinkling.

Drop-Hammer Forming

Mild forming on the drop-hammer is possible with cold dies. The blanks may be heated adjacent to the drop-hammer and struck before they have cooled. A second heating and forming operation will decrease the spring-back. The use of a lead punch is not recommended, as the lead contamination which results has been found to decrease the corrosion resistance of the material. Kirksite dies and punches, however, have been found satisfactory.

Stretch-Forming of Magnesium Alloys

Mild stretch-forming of magnesium alloys is possible at room temperature with annealed sheets, and fairly deep forming by this method is possible even with hard-rolled sheets when heat is applied. The usual method of applying heat is by heating the punch. However, experiments are being made with heating the sheet by infra-red lamps. A variation of this process which has been used successfully consists in squeezing the sheet to be formed between a heated punch and a sheet female mold which is gripped in the jaws of the press.

Dimpling Thin Magnesium-Alloy Sheets

Thin magnesium-alloy sheets can be dimpled readily by using heated tools. Tools designed to "coin" the dimples are recommended, as less difficulty with cracking results. The most successful method of heating has been to use electric resistance type heaters installed in the tools, with the temperature automatically controlled. Less difficulty with warping from this operation results if no attempt at preheating the sheet is made, but each hole is heated locally at the time it is dimpled. The use of induction heating for this operation appears interesting. Other forming tools, such as punch presses and rolls, have been used successfully with magnesium alloys.

Riveting Operations on Sheet Magnesium

Riveting of magnesium-alloy sheets presents little difficulty when protruding headed rivets are used. However, some difficulties occur with flush rivets. In the thicker gages of magnesium alloy, machined countersunk holes may be used. Tests have indicated that fatigue cracks may occur when rivets are driven in the normal manner in fairly thin sheet. Improvements are obtained, however, when the manufactured head is placed on the inside, with the countersunk head formed in the recess and the excess milled flush. Results are also improved by the use of normal countersunk-head rivets, driven with the head extending slightly above the surface and the excess milled flush.

Dimple countersinking must be employed on thin sheets, and the rivets must be driven carefully to avoid cracked dimples. It is difficult to join two dimpled magnesium-alloy sheets without cracking the dimple on the inner sheet unless very good dimpling technique is employed. Much less trouble is experienced when the dimpled magnesium-alloy sheet is riveted to aluminum-alloy members, because cracking seldom occurs in the outer sheet.

FS–1 alloy is superior to J–1 alloy in its resistance to cracking in riveting and in its resistance to fatigue cracks after fabrication. Rivets of 56S aluminum alloy should always be used with magnesium-alloy sheets because corrosion resisting properties with this combination are much better than with other rivet alloys.

Helium Arc Welding Magnesium Alloys

Butt welds are recommended for magnesium alloys. Tension joints with 80 to 90 per cent efficiency can be achieved by this type of weld. Shear joints are not desirable because they have much lower strengths.

Alloy J–1 can be satisfactorily welded by the helium arc process, and is recommended for structural assemblies involving sheet thicknesses of 0.064 inch or greater, thin sheets of this alloy being quite brittle. Extruded shapes can also be

welded. Alloy O–1, which is obtainable as extrusions or forgings only, can be welded satisfactorily by the helium arc process, and can even be welded to J–1 alloy sheet.

Sheet FS–1 can be welded only when the joint is free to expand and contract, and is not recommended for general application. Extrusions can be satisfactorily welded. Alloy M is arc-welded less easily than J–1, and normally should be torch-welded in non-structural applications. To avoid stress corrosion, alloys J–1 and O–1 must be stress-relieved for one hour at 400 degrees F., and FS–1 should be relieved for one hour at 275 degrees F.

Applicability of Gas Welding

As alloy M can be torch-welded almost as readily as aluminum for applications such as oil tanks, torch-welding is ordinarily used for this alloy, except in applications where it is difficult to apply or to remove the flux or where it is desirable to reduce the amount of the assembly that must be heated. Torch-welding is also used for the other magnesium alloys, but normally arc-welding is preferred because of the consistently higher strengths obtainable. As all flux must be removed after welding, the design of the structure should be such that there is no possibility of its being entrapped in the weld. This eliminates fillet welds in favor of butt welds, as seen in Fig. 2.

Spot-Welding Can Also be Applied

Although magnesium alloys cannot be spot-welded as readily as stainless-steel or aluminum alloys, successful spot-welds can be made. To assure a satisfactory corrosion-resistant finish, the surface of all spot-welds must be cleaned with a grinding compound on a buffing wheel, so that all traces of copper left by the welding tips are removed.

Chemical Treatment and Paint Desirable to Prevent Corrosion

In dry atmospheres, magnesium corrosion problems may not be serious, even with the material unprotected. However, where a warm, humid, corrosive atmosphere exists, magnesium alloys must be finished carefully with chemical and paint coatings. This is particularly true in cases where other metals, especially those far removed from magnesium in the electromotive series, are in contact with the magnesium alloy.

Chemical treatments serve to protect the surface and act as a paint base. They may also offer resistance to abrasion. Chemical treatments normally used are the sealed chrome-pickle and dichromate treatments, which are approximately equal in effectiveness. However, the sealed chrome-pickle treatment cannot be used in cases where dimensional tolerances are critical, because a small amount of the surface is removed during the treatment. The dichromate treatment does not change the dimensions of the part, but it cannot be used with M alloy.

An anodic treatment recently developed by the Consolidated Vultee Aircraft Corporation offers improvements as a substitute for these chemical treatments. In corrosion resistance tests, this treatment has proved to be equal in all respects to the chemical treatments, and it is superior in some ways. Unlike the chemical treatments, it offers good resistance to abrasion and will protect the magnesium alloy long after the paint finish has completely worn off. It has a high electrical resistance and is an excellent paint base. This treatment can be applied to any of the commercial magnesium alloys.

Standard paint finishes for use on magnesium alloys in aircraft applications consist of two coats of zinc-chromate primer on inner and outer surfaces, followed by aluminized lacquer or enamel on exterior surfaces. When dissimilar metals are in contact with the magnesium alloy, all faying surfaces of both parts should be primed carefully. With a finish of this type, the corrosion resistance of magnesium alloy is superior to bare Alclad, but the paint coating should be kept intact by touching up when necessary.

Preliminary tests indicate that when the Consolidated Vultee anodic treatment is substituted for the chemical treatments, a smaller amount of paint will give corrosion protection equivalent to that obtained with the chemical treatments and normal paint finish. If this proves to be true in future tests, a considerable weight saving will result.

Industry is often thought of as an aggregation of big businesses. As a matter of fact, what we usually understand by "Big Business" is not the chief employer in this country. Seventy per cent of the men and women employed in industry work in plants having less than 500 employes. Furthermore, considering distribution as well as manufacturing, it is estimated that nine to twelve million people are employed in enterprises employing four people or less.

Employment in the Reconversion Period

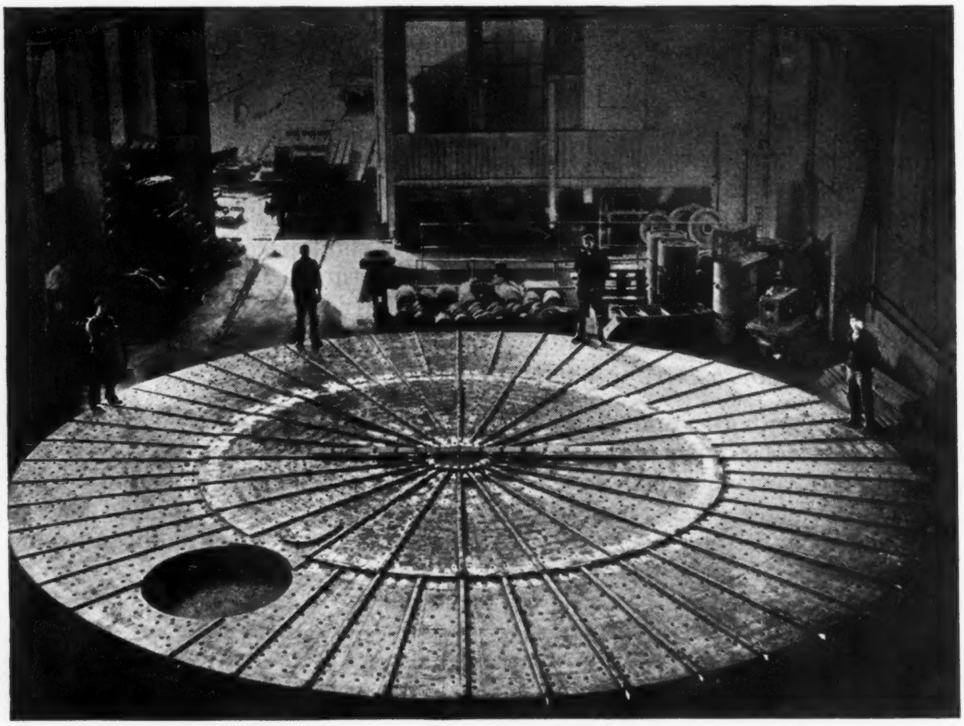
THERE has been so much loose talk about industry's obligation to provide employment that the following remarks by C. E. Wilson, president of General Motors, before the National Association of Manufacturers, may well bear repeating. Said Mr. Wilson: "Industry does not 'provide' jobs. Jobs are not created out of thin air. Jobs are the result of a great many factors. In the last analysis they depend on the customer's willingness to buy. Immediately after the war, it is believed that there will inevitably be a heavy demand for such things as automobiles, household appliances, housing, and, in general, durable consumer goods. The General Motor's $500,000,000 post-war program is based on this anticipation and on the further belief *that the people of our country will be willing to work for the things they would like to have.*

"With such an increased demand for goods, there should be an increase in industrial employment after the war, as compared with the pre-war period.... The production and consumption of goods is the principal measure of the standard of living of a country. The philosophy of opportunity, production, and plenty must replace the false philosophy of regimentation, restriction, and scarcity.

"The confusion that exists in some people's minds as regards their rights and obligations is, I believe, due to people who, with our increasing standard of living, expect a much greater social benefit than the contribution they are willing or able to make. If people are willing to earn what they expect to receive, and if they want things enough so that they are willing to work in order to get them, then there can be no question of the future of our country."

Laws that are contrary to the public conception of fairness are seldom respected. To be respected, a law must represent an accepted rule of conduct. Only such laws can be called good laws. All other laws usually express the ideas of a bureaucracy or incipient dictatorship.

This 40-foot Diameter Distributor Plate, Made by the American Brake Shoe & Foundry Co. for the Largest Vessel for Pressure Operation yet Built, is Made up of Ninety Heat-resistant Meehanite Castings. The Assembled Plate Weighs 65 Tons



Parallel Connection of Welders Provides Heavier Currents for Automatic Welding

By I. B. YATES
Air Reduction Sales Co.

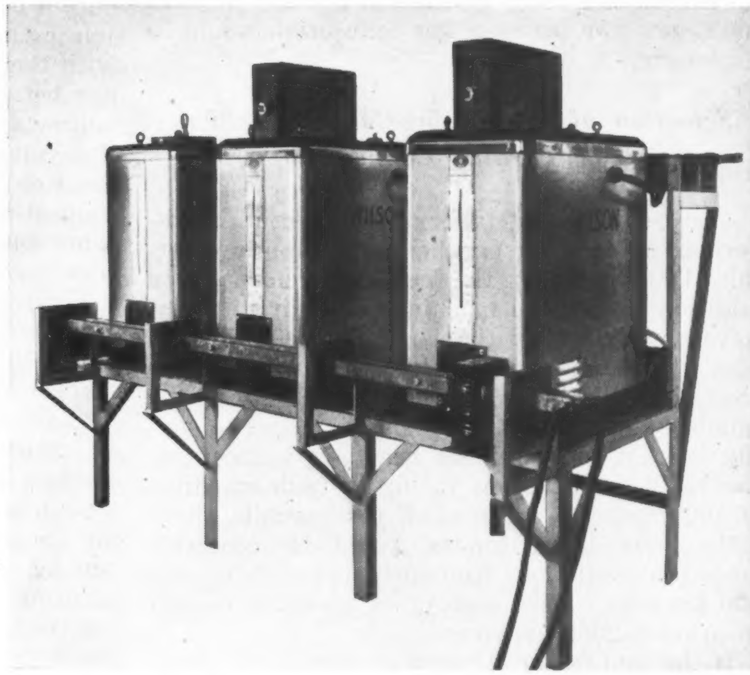


Fig. 1. Three 500-ampere Alternating-current Transformer Welders Connected in Parallel for Automatic Welding, with Switching to Permit Use of Each Unit Separately for Manual Welding. Busses are Not Exposed in the Final Installation

THE increasing use of continuous electric welding by means of automatic welding heads, requiring current supply in the 700 to 2000 ampere range, has repeatedly raised the question of whether smaller capacity welding generators or transformers can economically be connected in parallel to provide these heavy currents, and if so, how should the connections be made.

These questions are often provoked by the fact that some shops or departments have only occasional use for automatic welding, and prefer a more flexible and economical power installation than would be provided by a 1000- or 2000-ampere unit used exclusively, but only part-time, for automatic welding, with several smaller additional welders of 300- or 500-ampere size for use in manual arc welding.

If the same welders could be used for both purposes, much greater economy would be achieved. Similarly, in cases of setting up initially for automatic welding, the same generators or transformers now being used for manual welding might also be used in parallel, without need for an additional large capacity welder.

Provided that certain precautions are observed, it is a simple matter to connect and operate alternating-current transformer welders in parallel, and no more difficulty should be experienced than with direct-current generator welders connected in parallel. A fairly large number of installations have been made in this way. Since automatic welding is now being done with either alternating-current or direct-current (the latter coming into increasing use for this purpose), both types of set-ups will be described.

Connecting Direct-Current Welders

To obtain higher welding currents than are available with a single direct-current generator set, two or more drooping voltage machines of the same type and rating may be connected in parallel for combined output. In general, the instructions supplied by the manufacturer should be followed with regard to control settings and the use of equalizer connections. With some drooping voltage sets, all that is necessary is to connect the two or more electrode leads together and the ground leads together. All machines in the circuit must be set at the same voltage, and the connected leads must have the same polarity. Since parallel connection is employed to obtain higher output, it is natural that all machines should be used at their high-current settings; these settings should be the same in all units.

The use of paralleling switches on the output side is recommended when the units are connected for parallel operation. These switches should be opened before the welding sets are started or stopped. It is obvious that, if the output sides are connected together with the paralleling switch closed, when one machine is started, the other unit or units not running become a connected load on the operating generator. The same effect would occur if one machine of an interconnected group were shut off while some of the others were still running.

Tandem switches should not be used in connecting the machines to the power source, as the initial load on multiple starting would be excessive. Each individual unit should be started separately with its own starter switch.

Constant potential sets are rarely, if ever, used for automatic welding because of the waste of current in their resistors. Should they be used, however, an equalizer connection would be necessary.

Selection of Alternating-Current Welders for Parallel Connection

The selection of alternating-current transformer welders for parallel connection is determined primarily by the load requirements. In addition to this, all machines in a circuit must have approximately the same open circuit voltage, with a variation between them of not more than 10 volts. For continuous operation, the number and size of transformers needed to supply current to a welding head are based upon the NEMA continuous rating of each machine. If 1000 amperes are needed, for example, three 500-ampere transformers would be required, since the continuous load rating of each is only 400 amperes. Five such units would be needed to provide 2000 amperes.

If the load factor is less than continuous, however, higher currents can be drawn from each unit and the total output increased accordingly. If the work factor is such that the half-hour duty cycle can be applied—that is, a half hour under load and a half hour off—then the calculations may be based on the full ratings of the machines. Two 500-ampere units could then be used to supply 1000 amperes. All the foregoing procedures are in conformance with NEMA stipulations, and are, of course, the same as those applied to the use of a single transformer for manual welding. The use of the welders in multiple does not affect the output of any unit in the group.

Importance of Correct Phase Connections

In paralleling alternating-current transformers, it is important that all transformers be connected to the same phase, in case more than one phase is available in the alternating-current power supply, to insure the same polarity in the output of all units. This may be determined by joining the ground leads of two welders and, with the primaries energized, checking the voltage between the electrode leads, using either a voltmeter or a test lamp. If the lamp lights, or if a voltage of more than 10 volts is registered, the welders are out of phase, and the primary connections of one unit should be reversed. The same procedure is applied to each additional transformer in the group.

When all units are in phase, the voltage registered between electrode leads should be within 0 and 10 volts. In case there is a difference of more than 10 volts in the secondary no-load voltages (which may occur when different makes or types of alternating-current transformer welders are used together), then there will be a circulating current in the secondary coils during the idling period. This undesirable condition can be corrected by tapping in at a different point on the secondary coil of the non-conforming transformer, or even on the primary coil, if this is more convenient, to bring its open circuit voltage into line with the others. Sound electrical connections of ground and electrode leads can be made after phase and voltage are in agreement.

Primary Switching Connections

Primary connections of alternating-current welders having capacitors for power factor correction should be so arranged that no one primary can be disconnected while others are energized. The excitation of the secondary coil in the "off" transformer may damage the primary capacitors by supplying current to them through

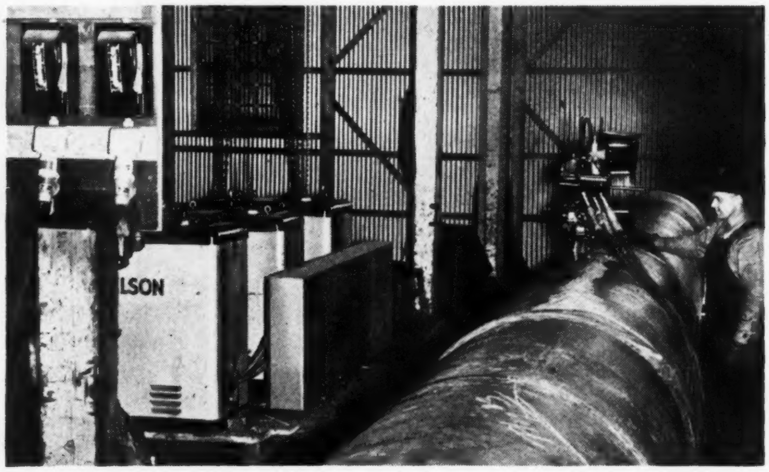


Fig. 2. Here Welders are Used with Parallel Connections to Provide Sufficient Current for the Automatic Arc Welding of the Masts of Cargo Ships

the high reactance of the transformer. Thus, separate switching connections of the several primaries should be avoided, preferably by joining all primary leads to a single pair of busses without intervening switches or fuses, and controlling the entire circuit through a single switch.

The installation shown in Fig. 1 is equipped with a master switch, but in addition, individual cut-off switches are provided for all units to facilitate their use separately in manual welding. However, the secondaries are also disconnected for this service, as will be described later.

If for any reason it is not practicable to operate all units through a master switch, the individual switches should be arranged to disconnect the capacitors, as well as the primaries. It is also desirable to employ discharge resistors on the capacitors to take care of the residual charges which may remain in them after being disconnected.

The installation shown in Fig. 2, consisting of three 500-ampere transformer welders, employs individual switches, and is used in the fabrication of masts for cargo vessels. These masts are made up of four sections of plate rolled to cylindrical shape and butt-welded along the longitudinal seam by automatic welding. Manual arc welding also enters into the fabrication work in depositing an initial back-up bead in this joint, and in making fillet welds in the telescopic joints between sections of the mast. For this manual work individual welders are, of course, used.

Secondary Switching Connections

The preferred method of switching to permit easy change from parallel to individual operation of welders is to provide double-pole, double-throw switches at the secondary side of each unit. These switches connect the secondary leads alternately to the busses for parallel operation and to ground and electrode terminals for separate operation. It is then a simple matter to make the change, and the same welders can be used for both types of operation without loss of time.

This flexible set-up is obviously more economical, in shops having only occasional need for heavy currents, than a single large unit of 1500 or 2000 amperes, which would not be practical for manual welding and would therefore stand idle much of the time. Selection of welder size can thus be based upon the kind of job most commonly encountered, using the parallel arrangement for the less frequent heavy welding jobs.

In the installation shown in Fig. 1, for example, the welders are in actual operation about 50 per cent of the time on manual welding and about 20 per cent of the day on automatic welding in the fabrication of heat exchangers and pressure vessels. Both methods of welding are used on different portions of the same product.

Current Settings

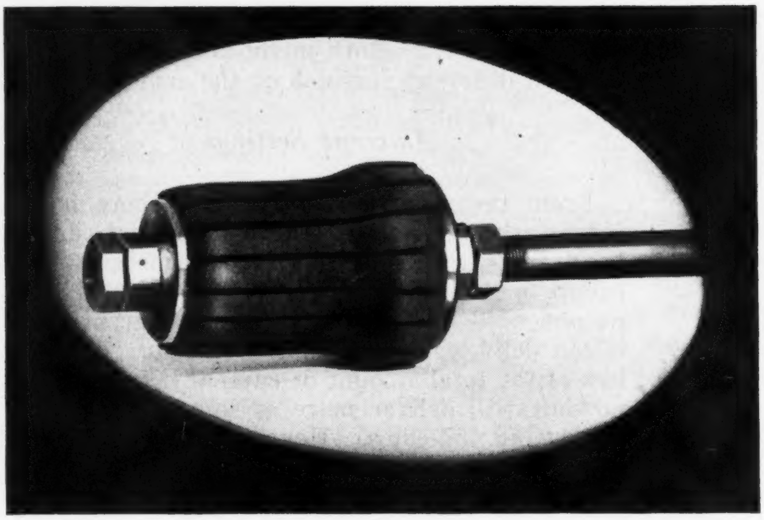
From the standpoint of safety, there is no reason why different amounts of current cannot be drawn from different transformers in the group to give the required total, provided that no one welder is set to give more current than it can deliver in individual operation. Regardless of the total amount of current being drawn, no unit will deliver more or less current than its setting indicates. However, it is desirable from the standpoint of welder life to set the machines at about equal output. It is not the best practice to set one unit at maximum output and build up and regulate the desired total on the second machine, as this will throw the bulk of the load on one machine. Within reasonable limits, therefore, current adjustments should be made to keep both or all welders in approximate balance. If desired, motorized remote control of current setting may be included in the installation. This saves considerable time in making adjustments, and centralizes all controls on the panel of the automatic welding head.

* * *

Tool Engineers Postpone Exposition and Convention

The American Society of Tool Engineers, an organization comprising over 17,000 production executives and engineers, has announced that the Industrial Production Planning Exposition, scheduled to be held in Cleveland, Ohio, in March, and the convention of the Society, to be held at the same time, have been indefinitely postponed in response to the request of James F. Byrnes, Director of War Mobilization, for curtailment of conventions and association meetings.

In deciding to cancel the meeting and the exposition, the Society took due note of the fact that its expositions and technical sessions on production methods and planning have come to be considered an important aid to the war production effort, since at these meetings and expositions, tool engineers throughout the nation have been able to survey quickly new processes, machines, tools, and equipment that would speed war production. The postponement of the meeting and the exposition does not mean that the Society is curtailing its other technical and educational activities. If anything, these will be intensified and supplemented, in order to make up for the loss in direct exchange of ideas occasioned by the postponement of the previously scheduled meeting.

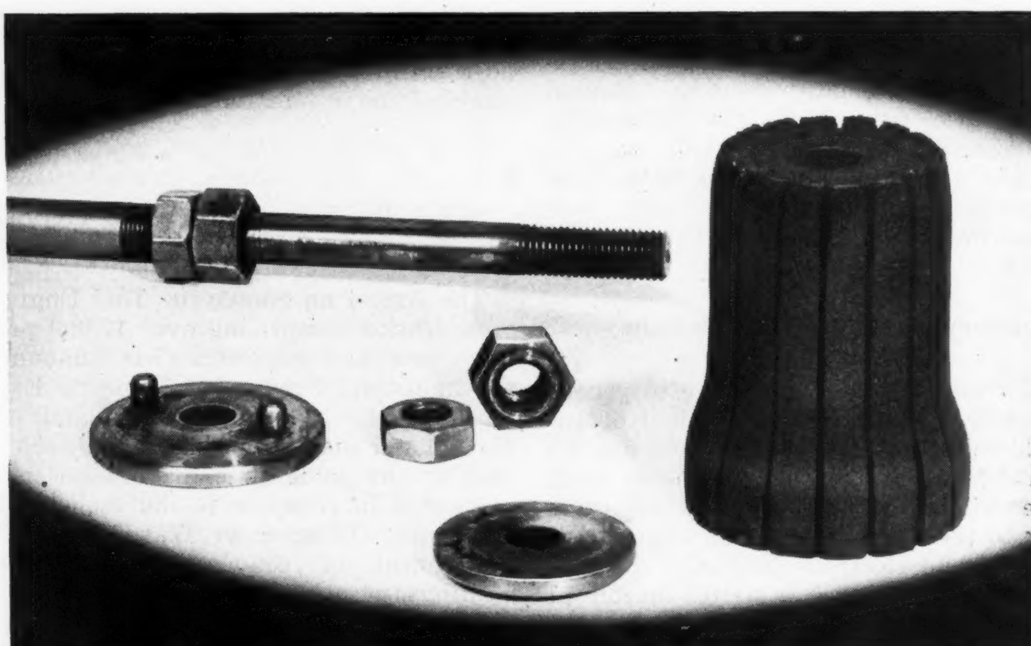


Rubber Tools

RUBBER impregnated with abrasive is used quite extensively by the General Machinery Ordnance Corporation, of South Charleston, W. Va., for polishing operations. A tool of this kind is employed, for example, in polishing the shell centering slope of a gun chamber and the area in front of the slope. As shown in Fig. 1, this tool is of the same outline as the surface to be polished. The rubber is solid with shallow grooves that give flexibility to the polishing periphery. Details of the tool are seen in Fig. 2.

Another abrasive-impregnated rubber polishing tool is shown assembled in Fig. 3 and disassembled in Fig. 4. This head is employed for polishing the lands, sides, and

Fig. 1. (Above) Abrasive-impregnated Rubber Tool Used for Polishing Shell Centering Slope of a Gun Chamber and the Area in Front of the Slope. Fig. 2. (Below) Details of the Abrasive-impregnated Chamber Polishing Tool Illustrated in Fig. 1



Cemented-Carbide Wheel-Dressers

Wheel-dressers made with small commercial diamonds set into a matrix of Carboloy have made possible a considerable saving in time and cost at one of Detroit's largest aircraft engine plants for truing recesses in grinding wheels. When a conventional single-diamond dresser was used for the recessing operation—which is necessary in order that the wheel may produce a sharp corner at the bottom of a cylinder sleeve flange—the holder had to be ground flat and the diamond lapped so that the stone would perform the dishing-out operation correctly without the holders touching the edges of the recess when swinging it through an arc.

The Carboloy diamond-impregnated dresser, on the other hand, has diamond particles distributed throughout the matrix, thereby insuring that at least one or more of the stones will be constantly in contact with the grinding wheel as the holder is swung through a small arc. Lapping and remounting of the single diamond are thus avoided.

for Polishing

bottoms of the rifling grooves in a 5-inch 38-caliber gun—all at the same time. There are three rubber members—two of them impregnated with abrasive, and one plain rubber ring, somewhat smaller in diameter, which is assembled between the other two. The rubber polishing rings can be expanded radially by tightening nuts to advance steel plates along the bolt on which they are mounted. Coolant is employed in all operations involving the use of these rubber abrasive-impregnated tools.

Other tools that utilize rubber for guiding boring cutters or expanding honing stones were described in an article published in December, 1944, MACHINERY. They were also developments of the General Machinery Ordnance Corporation.

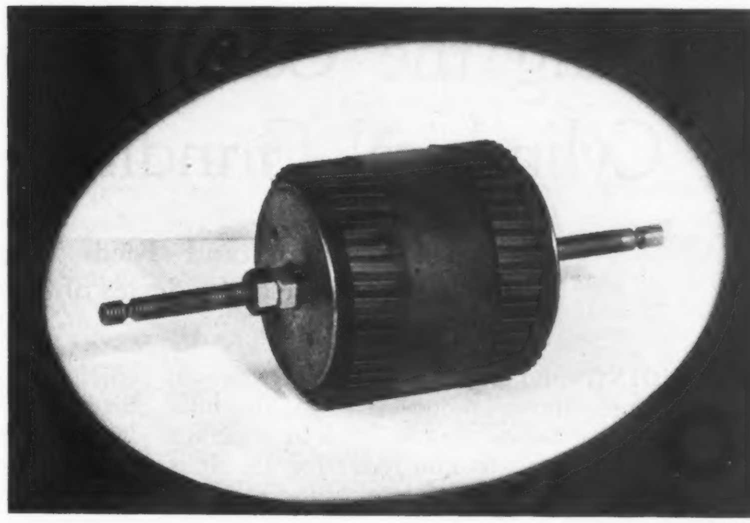


Fig. 3. (Above) Another Abrasive-impregnated Rubber Polishing Tool Employed for Polishing the Lands, Sides, and Bottoms of the Rifling Grooves in a 5-inch 38-caliber Gun after the Honing Operation. Fig. 4. (Below) Details of the Abrasive-impregnated Rubber Polishing Tool that is Shown in Fig. 3

Lubrication of Gearing

Standard specifications pertaining to the lubrication of enclosed and open gearing have recently been approved and released by the American Gear Manufacturers Association, Empire Bldg., Pittsburgh 22, Pa. The publication of these specifications for gear lubrication should be of great value to all users of gearing. The information given covers in considerable detail all that the gearing user would normally need to know with regard to gear lubrication. A valuable part of the specifications is a chart which gives trade names of typical oils that meet the recommendations for lubricating enclosed and open gearing.

* * *

Ball and roller bearings have a definitely predictable life. The life of a large group of bearings operating under a known load, with predetermined speed and mounting conditions, can be forecast with considerable accuracy.

Selecting the Correct Speeds and Feeds for Cylindrical Grinding

By S. S. SHOEMAKER
Landis Tool Co., Waynesboro, Pa.

How Speeds and Feeds Affect Wheel Action – First of a Series of Three Articles

GRINDING engineers are frequently forced to turn down requests from machine shops for tables that will tell at a glance the most efficient speeds and feeds for all kinds of work, all types of materials, various amounts and rates of material removal, and all qualities of finish. A request for such information is a natural one, as it is generally realized that for every grinding job there is one combination of speeds and feed at which a certain grinding wheel will produce most efficiently. However, such tables are feasible for tool steel and carbide cutting tools, but not for grinding wheels. The reason is that, in grinding, very slight differences in the characteristics of work material, wheel specifications, or operating conditions often make very great differences in the production rate and the surface qualities secured, even though the speeds and feeds remain constant.

Any grinding job, no matter how seemingly simple, is actually quite complicated, because at least ten variables are involved. If even one of these variables is changed while the others remain constant, the performance of the wheel is practically certain to change considerably. These variables are the grade, or bond strength, of the wheel; the type and size of the abrasive grains; the wheel structure; the width of the wheel face; the wheel speed; the speed of rotation of the work; the rate of traverse; the in-feed; and the personal characteristics of the grinding machine operator.

Other factors that must be considered in setting speeds and feeds are the work material; shape of work with reference to unbalance and slenderness; adequate support of the work by work-rests; rigidity and condition of grinding machine; method of truing or dressing the wheel; and accuracy and finish required. These variables and unforeseeable factors make it obviously impossible to work out a chart or a hard-and-fast set of rules that would be universally applicable, from which exact speeds and feeds can be picked off.

Nevertheless, it is possible to give certain basic ranges of speeds and feeds to use as a starting point. Then with a knowledge of what governs the wheel action and some experience, any reasonably intelligent man can, with a little experimenting, determine the most effective and efficient speeds and feed for the job at hand. Seeing how the wheel acts at the first setting, he will at least know in which direction to change the speeds and feed. So, although the problem is quite complicated, the solution can be simplified.

Theoretically, the best practice might seem to be to start by selecting as well as possible the best speeds and feed, and letting them determine what wheel to use. But because there are practical limits to the range of speeds and feeds, it is the usual practice—and probably as satisfactory a one as any—to select a wheel from the tables of wheel recommendations for various jobs that wheel manufacturers provide, and fit the speeds and feed to the wheel.

Admittedly, this would be putting the cart before the horse, if it were not for one thing. Wheel manufacturers have experimented widely and carefully with each wheel they make on all of the commonly used work materials and at various speeds and feeds. Therefore, when they recommend a wheel for a job, we can be reasonably certain that it is the right wheel to use at the most efficient speeds and feed for the finish required, under normally good shop conditions. If a job has unusual characteristics, or if the grinding conditions vary much from normal, it will be necessary to experiment with different speeds, and usually with the rate of in-feed.

If it still is not possible to secure quite the production and finish desired, it will be necessary to select a wheel slightly different from the one recommended. But the recommendations are so carefully arrived at that usually the wheel selected as a substitute will be only slightly different in grade from the one suggested. This compromise should give the fastest production with the least possible wheel wear under the conditions in the shop.

Effect of Too Hard or Too Soft Wheels

Obviously, the act of grinding sets up in the wheel, stresses of shear and compression which tend to break both the abrasive grains and the bond which holds the abrasive grains in the wheel. If the bond is of the right grade—that is, strong enough, but not too strong—the abrasive grains will fracture as soon as they be-

come too dull to cut well, owing to the increased stresses caused by their dullness and so present new sharp edges to the work. When all the sharp edges have been used, the completely dulled grains are pulled from the bond by the extra shear stress set up by their dullness.

If the bond is too strong—that is, if the wheel is too "hard"—the increased stress is not sufficient to pull the grains from the bond after they become too dull to cut. Since material can be removed only by a cutting action, production declines. Furthermore, the face of the wheel loads and glazes, so that it merely rubs the work, and therefore is likely to burn it. This can, of course, be temporarily rectified by opening up the wheel face with a dressing tool, but the condition will recur constantly.

If, on the other hand, the wheel is too soft for the job, even moderate stresses will tear the grains from the bond long before they have become dull enough to lose their cutting ability. As a result, the wheel will be free cutting and the production rate will be high, but the wheel wear will be out of all reason.

It is important to remember that when a wheel is operating exactly right, the stresses are close to the ultimate strength of the grains and the bond, so that any slight increase of stress will fracture the grain or tear it from the bond, and any slight decrease will permit the grains to become too dull. It is evident that the magnitude of the stresses set up in grinding determine whether a given wheel will be too hard, too soft, or just right for the job.

Effect of Speeds and Feeds on Stresses Set up in Wheel

Important factors in determining the stress set up in a wheel of definite grade, or hardness, are the actual rotational speeds of the wheel and of the work, the traverse speed, and the amount of in-feed. To change any one of these factors, all others remaining constant, will decrease or increase the stresses and make the wheel act harder or softer than its rated grade, thus affecting the production and the wheel wear. It will also affect the quality of the surface finish secured.

What the effects of some of these changes will be is not always self-evident. In fact, some of them are exactly the opposite of what would be expected. Thus it is a mistake to believe that increasing the wheel speed, while work speed, traverse, and feed remain unchanged, will, of itself, increase the rate at which material will be removed. The grain and bond will be subjected to smaller stresses. The grain will therefore not fracture so soon, will be held in the bond longer, will become duller before it is torn out, and the wheel will act harder than its rated grade. That is, it will cut more slowly and production will decrease just as though the wheel were originally too hard for the job.

In the same way, to one unacquainted with the effects of the various stresses, it might seem that to reduce the speed of work rotation and traverse would necessarily reduce the rate of material removal. It would, if the in-feed were kept the same. But the lower work speeds reduce the stresses set up by them, so that the increased stresses caused by a deep in-feed will not make the wheel act too soft. Therefore much heavier cuts can be taken, provided the piece is large enough in diameter not to be bent by the increased pressure. The result is heavy stock removal. It is a good method to use for roughing, but not for finishing, for light cuts are essential to good surface quality.

In-feed sets up compression stresses only, although with a deep cut, the shearing stresses set up by the movements of wheel and work increase somewhat as the grains penetrate deeper. For that reason, and because the greater compression stresses act to fracture the abrasive grains, heavy in-feeds tend to make a wheel act softer, and vice versa.

Conditions Vary in Mass Production and Job Shops

It is evident that by manipulating speeds and feeds it is possible, to a certain extent, to make a poorly selected wheel act either harder or softer; but production or finish will suffer to some extent. Therefore, it is not recommended for a mass production job. For such work, great care should be taken to settle upon exactly the right wheel for each grinding job, and equal care expended in experimenting to find exactly the right speeds and feed for each job.

In a job shop, where a wheel seldom can be used up on a single job, it is often necessary to use a compromise wheel that is not ideally suited for the work, and to manipulate it. Some operators become so skillful that they claim they can "baby" a wheel of medium grit and grade to do everything from heavy material-removing roughing cuts to producing a mirror finish—all with the same wheel. That is skillful grinding, but it wastes a lot of time. It is better to select, as nearly as possible, the right wheel, and make the compromises as to speeds and feeds as small as possible.

Each Shop Should Collect its Own Data

Although, as has been said, no universally applicable tables of speeds and feeds are available, it is possible and highly desirable for every shop to build up its own grinding data and tabulate it in some way. If, after experimenting with a job in the light of the suggestions given in this article, the data is set down, it will not

be long before it becomes possible to make such a table. It will be invaluable, not only in saving time at the start of each job that would otherwise have to be spent in experimenting, but also as a source of information for new jobs. Some shops use the data secured in this way to build up piece rates or standards of production for every new job that comes into the shop.

Such a table for an individual shop should contain the following headings: Type of machine; machine number; wheel specifications in full; a sketch or good description of the piece; material of the piece; wheel speed; work rotational speed; traverse; in-feed; finish required. Separate columns will, of course, be used for the roughing and the finishing cuts, so far as the speeds and feeds are concerned.

Even with such data, a shop should occasionally experiment on jobs that are believed already to be done with the best possible speeds and feeds. Grinding wheels and grinding machines are constantly being improved, so that it is quite possible for a grinding procedure to become obsolete practically over night.

* * *

Cornell to Increase Length of Engineering Courses

In order to adequately train engineers for the leadership they will eventually assume, Cornell University will increase from four to five years the length of time required for all its engineering courses after the war.

For a degree under the five-year curricula, 180 credit hours will be required, of which not less than 125 must be in scientific and technical subjects, and not less than 36 in managerial and non-technical courses. The non-technical subjects will include economics, English, history, philosophy, government, and sociology, with other subjects added from time to time. The non-technical subjects will be arranged in successive order throughout the five years, running parallel with the technical studies.

* * *

National Metal Trades Association Postpones Convention

The executive committee of the National Metal Trades Association, 122 S. Michigan Ave., Chicago, Ill., having more than 1150 member plants engaged in war work, has announced the postponement of the annual convention scheduled to be held February 26 to 28 in New York City. This action was taken in support of the request of James F. Byrnes, War Mobilization Director, for curtailment of convention travel during the war.

Westinghouse Resistance Welding Training Course

The Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has published a welding control training course. The object of this course is to present in a clear and understandable manner how welding processes differ, how electronic control for resistance welding works, and how this method of control adapts the resistance welding process to industry.

This course was produced primarily for Westinghouse employes, but the material has now been made available to other industrial organizations at production cost. It is recommended that from eight to ten hours be allowed for the full seven-part course, divided into about two hours each for four lessons. Those interested in this course should address C. R. Riker, Supervisor Extension Training, Westinghouse Electric & Mfg. Co., 306 Fourth Ave., Pittsburgh, Pa.

The subjects covered by the course are as follows: (1) Basic Definitions of Welding Technology: Forge Welding, Gas Welding, Thermit Welding, Electric Arc Welding, and Resistance Welding. (2) Types of Resistance Welding Work: Spot, Projection, Seam, Butt, Flash, and Duty Cycle. (3) The Ignitron and the Thyratron: Fundamentals of Electronic Tubes, Ignitron and Thyratron. (4) How the Flow of Resistance Welding Current is Started and Stopped. (5) How the Amount of Resistance Welding Current is Controlled; Phase Shift Heat Control. (6) Electronic Timing Controls in Resistance Welding: Basic Principles of Electronic Timing; Synchronous-Precision Weld Timer; Non-Synchronous Timer; and Sequence-Weld Timer. (7) Energy-Storage Control: Capacitor-Discharge Type and Magnetic Type.

Slide films and records for the lessons give clear explanations of the basic theory and applications. Seven lessons in handy pocket size, reproducing the subject matter of each lesson, are provided for each member of the class, thus affording convenient means of review and supplemental study. A quiz book is supplied to each member of the class for final review of the subjects covered, and an instructor's manual gives suggested classroom procedure for the entire course. Informative booklets on resistance welding in industry supplement the material in the course.

* * *

"Industry," in the broadest sense, represents everything that has to do with production, including farming. "Business" includes everything that has to do with distribution. Both are equally important; industry starts the cycle, business carries it on.—*George T. Trundle, Jr., in "Trundle Talks."*

Flame-Hardening Piston-Ring Grooves in Locomotive Pistons

By STEPHEN SMITH
Flame-Hardening Specialist
Air Reduction Sales Co.

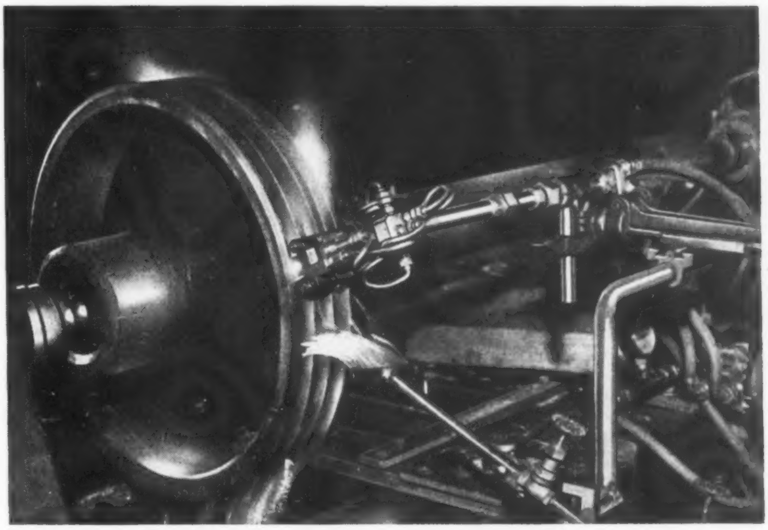


Fig. 2. Arrangement for Flame-hardening Piston-ring Grooves in Piston-heads 26 Inches in Diameter

THE railroads throughout the country are more and more applying oxy-acetylene flame-hardening on railroad equipment that requires frequent repairs because it is constantly subjected to wear. One of the principal locomotive parts subjected to severe service is the piston-head. During the motion of the piston in the cylinder the piston-rings are forced alternately to one side of the piston-ring groove and then to the other. This alternating pressure against the walls of the ring grooves, in conjunction with the action of other forces, gradually wears down the walls. As the amount of wear increases, the rate of wear also increases, until the efficiency of the piston is seriously reduced. Repair or replacement of the piston-head then becomes necessary.

To reduce this wear and to prolong the life of steel piston-heads, a number of railroads are now flame-hardening the walls of the piston-ring grooves or specifying that they be flame-hardened by the manufacturer. This operation is quite simple, and can be carried out with a minimum of equipment and set-up time by following standardized procedures.

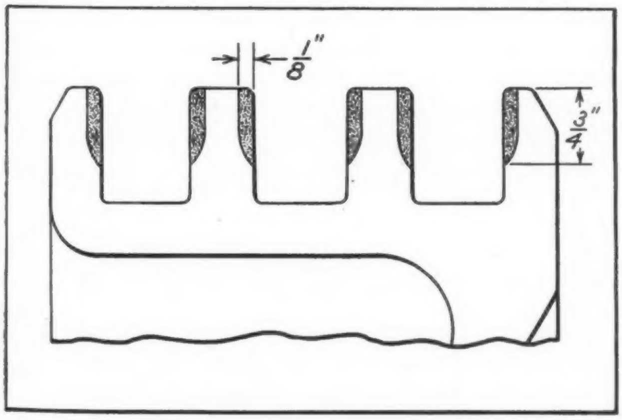


Fig. 1. Diagram of Flame-hardened Piston-ring Grooves, Showing Extent of Flame-hardened Section

Since the ring-groove wear takes place gradually from the top of the groove wall downward, it is necessary to flame-harden only the top portion of the walls for a distance of 1/2 to 3/4 inch down from the top of the piston-ring groove, as indicated diagrammatically in Fig. 1.

A simple set-up for flame-hardening piston-ring grooves in a railroad shop is shown in Fig. 2. The piston-head is mounted on a piston-rod, and the whole assembly placed between the centers of a lathe, geared to rotate the head at a constant speed for progressive hardening. The speed will vary with the size of the head and of the grooves to be flame-hardened. The piston-head shown in the illustration is 26 inches in diameter, and the speed of hardening 6 1/2 circumferential inches per minute. It is recommended that variable speed over a range of from 4 to 8 inches per minute be provided, so that the speed can be properly adjusted and coordinated with the heat to give the required depth of hardness.

The hardening is done by a special torch tip which actually has three separate multi-flame tips, each of which fits into one of the grooves and heats and quenches both walls simultaneously. The six walls are thus treated in a single operation. As shown, the three-part tip is held by a torch-adjusting arm, mounted on the lathe carriage; this arm is essential for maintaining the fine adjustments necessary in locating the tips in the ring grooves.

In addition to the quenching jets incorporated in the tip, an auxiliary cooling quench is set up below the tip, as shown in the illustration, to take care of any residual heat in the piston.

The walls of all the grooves are flame-hardened by the progressive method in one revolution of the piston-head. It takes twelve minutes to harden heads of the size shown. The surface hardness depends on the chemical analysis of the piston; but, generally, a Brinell hardness of from 450 to 550 is desired and obtainable. Approximately 30 cubic feet of acetylene and 33 cubic feet of oxygen are used in flame-hardening a 26-inch diameter head.

At least one manufacturer of railroad equipment has been hardening the grooves of locomotive piston-heads by the oxy-acetylene process for nearly two years, thus giving assurance of longer life and reduced maintenance of piston-heads.

* * *

A Fundamental Analysis of What Has Happened to Our Government

A thought-provoking book entitled "The Revolution Was," by Garet Garrett, has been published by Caxton Printers, Ltd., Caldwell, Idaho. This book, of somewhat over fifty pages, concisely points out how, during recent years, an actual revolution has taken place in the form of the government of the United States—converting it to a large extent into a government by the Executive, and by commissions, boards, and bureaus appointed by him. Government by executive order has largely taken the place of the type of government to which this nation had become accustomed during a century and a half.

It is further pointed out how state powers have been concentrated in the Federal Government, and how the rights of the individual have been limited, and the rights and activities of individual business enterprises curtailed. This is a book every man and woman who wishes to obtain a clear picture of what has been accomplished in the direction of curtailing the freedom of the individual and of individual enterprise ought to read. The manner in which Government has recently, under the pretext of the war emergency, seized a private business enterprise, gives added emphasis to the facts related in this book.

* * *

Stroboscope for Extreme Speeds and Vibrations

A stroboscope that increases the range through which moving objects can be examined has been developed by the Communication Measurements Laboratory, 120-24 Greenwich St., New York City. It is stated that, by means of this device, rotary speeds of 600 to 600,000 R.P.M., or vibrations of 10 to 10,000 C.P.S., can be "stopped" and studied.

When Industry is Presented in Wrong Light by Educators

Some time ago, a large industrial organization discovered by means of a careful poll of public opinion that its standing among the younger people in a certain state was far below the average throughout the country, and also below that in other age groups in the same state. Searching for an explanation, the corporation found that text-books used in recent years in the public schools of that state were found to present this industrial organization quite inaccurately in an unfavorable light.

"When a newspaper reports on industry inaccurately," said one of the officers of the organization, "no great harm may be done, provided such errors are not repeated, but when a standard text-book or reference work contains inaccurate passages, the harm is perpetual. The error becomes part of the current beliefs of a generation of students."

To bridge this chasm between responsible scholarship in education and industrial organizations, a movement is now under way to effect a closer understanding between the two. Information as to how an individual business may go about doing its part to make available to reputable authors of text-books the actual facts may be had by any industrial executive by communicating with Stanley Pargellis, Newberry Library, Chicago, Ill., or Thomas C. Cochran, New York University, New York City.

* * *

Protective Coating for Spray Booth Side Walls

A protective coating for the side walls of spray booths has been placed on the market by the Detrex Corporation, 13005 Hillview Ave., Detroit 27, Mich. The new coating is known as Triad PR. When this coating is used between the walls and the layer of overspray that normally builds up, the booth wall is so protected that it can be stripped clean simply by spraying with water or steam. The coating can be applied either by brushing or with a spray gun. It dries to a hard, white, dustless covering, which improves visibility in the booth.

* * *

New Process for Blacking Steel

A new process for blacking steel has been developed by Protective Coatings, Inc., Box 56, Detroit 27, Mich. This process is claimed to give exceptionally good results at low cost. It is performed at temperatures ranging from 130 to 300 degrees F.

Differential Hobbing Solves Spur-Gear Problem

By VICTOR E. FRANCIS
National Broach & Machine Co.
Detroit, Mich.

THE problem of hobbing a prime number of teeth in a spur gear without using an index-gear having either the same number of teeth or some multiple of it is one that frequently occurs in gear departments which do not have a complete set of change-gears. When such a problem occurs, the procedure ordinarily followed is to hob an index-gear having either the same prime number of teeth required on the spur gear, or some multiple of it, using the change-gears which are at hand to get as close to the correct ratio as possible.

Since the ratio is not exact, however, the index-gear produced will have a small helix angle. If this helix angle is small enough, the gear so produced can be used to mesh with the spur gears in the index train, and thus the exact ratio required can be obtained for hobbing the spur gear.

Anyone who has followed this procedure, however, realizes the amount of labor involved in finding the right combination of change-gears which will cut an index-gear having a sufficiently long lead to make it usable in the index-gear train. Another difficulty frequently encountered is that the change-gear required may have an exceptionally large prime number of teeth (such as 149, for example), so that it may be impossible to place it in the index train.

These difficulties can be overcome, however, by a second procedure, which can be followed if a differential hobbing machine is available. The conventional method for cutting a spur gear on a differential hobbing machine is to place gears in the index train having a ratio of $\frac{R}{N}$ where R is the index constant of the machine and N is the number of teeth to be cut. The correct feed gears are selected and the lead train is locked.

If a helical gear with the same number of teeth is to be cut, the same index train as before having a ratio of $\frac{R}{N}$ is employed, regardless of the lead or helix angle. The lead train is now utilized, however, and if the hobbing machine is of the type where the differential is placed after the index-gears, the gears placed in the lead train have the ratio of $\frac{K}{L}$, where K is the lead constant of the machine and L is the required lead of the helical gear. If, however, the machine is of the type where the differential is placed before the index train, then the lead train must have the ratio $\frac{NK}{L}$.

Returning to the problem of cutting a spur gear with a prime number of teeth, suppose that a 67-tooth gear is required and the index constant of the machine is 12. Then the index train might be some such combination of gears as $\frac{36}{67} \times \frac{30}{90}$, $\frac{36}{67} \times \frac{25}{75}$; or $\frac{24}{67} \times \frac{40}{80}$. In any case, a 67-tooth index-gear would be required.

Suppose that a 67-tooth index-gear were not available, but that the combination of index-gears at hand which gave the closest approximation to the desired ratio was, say, $\frac{30}{78} \times \frac{40}{86}$ or $\frac{30}{72} \times \frac{40}{93}$. Instead of the desired ratio of $\frac{12}{67}$, the first combination of gears would give a ratio of $\frac{12}{67.08}$, and the second a ratio of $\frac{12}{66.96}$. As a result, depending upon which of these two combinations of change-gears was used, the gear being cut would be advanced or retarded a certain amount during each revolution and a helical gear would, in fact, be cut having a lead that could be readily determined.

The principle of the second procedure is to compensate for the lead produced as a result of the slightly incorrect index-gear ratio by using the lead-gear train. Since the lead-gear train is independent of the index-gears, it can be set up to produce an opposite-hand lead equivalent to that produced by the index-gears. This will, in effect, cancel out the angle that would be produced by the index-gears alone, and consequently, a spur gear would be produced having the desired prime number of teeth.

The procedure in detail is as follows:

1. Determine the decimal equivalent Q of the desired index-gear train ratio by dividing the index constant R of the hobbing machine by the number of teeth N to be cut on the spur gear. Thus

$$Q = \frac{R}{N}$$

2. Determine the combination of index-gears that will give an approximate ratio Q_a as close

to Q as possible. (Note: Fractional equivalent tables such as those given in the book "14,000 Gear Ratios," published by THE INDUSTRIAL PRESS, might be used for this purpose.)

3. Divide the index constant R by the approximate ratio Q_a to get the approximate number of spur gear teeth N_a that would be cut if this ratio were used. (Note: Since, actually, a gear with N teeth which are helical would be cut by an approximate ratio, N_a is only a theoretical value used for a subsequent computation.)

$$N_a = \frac{R}{Q_a}$$

4. Subtract the approximate number of teeth N_a from the actual number of teeth N to obtain the deviation factor m. (The actual deviation or amount that the gear over-runs or under-runs in each revolution is equal to the deviation factor m times the circular pitch p of the gear being cut.)

$$m = N - N_a$$

It may be noted that if the combination of change-gears selected gives a close approximation to the desired ratio, $N - N_a$ will be a small decimal. Thus, in the case mentioned, where the desired ratio was $\frac{12}{67}$ but the available combinations of index-gears gave ratios of $\frac{12}{67.08}$ and $\frac{12}{66.96}$:

$$N - N_a = 67 - 67.08 = -0.08$$

$$N - N_a = 67 - 66.96 = 0.04$$

5. Compute the lead L produced by the approximately correct train of index-gears with the lead train locked. Since the actual deviation is measured on the pitch circle in a plane perpendicular to the gear axis and the feed is measured parallel to the gear axis, the tangent of the helix angle A cut by the approximately correct index train, with the lead train locked, is equivalent to the actual deviation m times the circular pitch p divided by feed f.

$$\text{Tan } A = \frac{mp}{f}.$$

The lead L equals the pitch circumference of the gear (π times D, where D is the pitch diameter) divided by the tangent of this helix angle.

$$L = \frac{\pi D}{\tan A} = \frac{\pi D}{\frac{mp}{f}} = \frac{\pi Df}{mp}$$

Since $\frac{\pi}{p}$ = diametral pitch P,

$$L = \frac{DPf}{m}$$

But $D \times P = N$. Hence

$$L = \frac{Nf}{m}$$

6. Select a combination of lead gears that would produce a lead equivalent to L, but of opposite hand. For the type of differential hobbing machine in which the differential is placed after the index-gears, this combination of lead gears must have a ratio U equivalent to the lead constant K of the hobbing machine divided by the lead L. Thus

$$U = \frac{K}{L}$$

For the type of hobbing machine in which the differential is placed before the index train, the lead train ratio U equals the lead constant K times the approximate number of teeth N_a divided by the lead L.

$$U = \frac{KN_a}{L}$$

A specific example will, perhaps, show more clearly the exact procedure. Suppose that a 151-tooth spur gear is to be cut and a satisfactory combination of change-gears is not available. The following data are given: $N = 151$; $K = 25$; $R = 12$; and $f = 0.040$.

1. Compute the desired index-gear ratio:

$$Q = \frac{R}{N} = \frac{12}{151} = 0.0794702$$

2. The nearest decimal equivalent of an available combination of index-gears, taken from an equivalent fractions table for gear ratios, is then found:

$$Q_a = 0.0795455 = \frac{7}{88} = \frac{27}{99} \times \frac{28}{96}$$

(index-gear train)

3. Compute N_a:

$$N_a = \frac{R}{Q_a} = \frac{12}{0.0795455} = 150.85706$$

4. Determine the deviation factor:

$$m = 151 - 150.85706 = 0.14294$$

5. Compute the lead produced by an approximately correct combination of index-gears:

$$L = \frac{Nf}{m} = \frac{151 \times 0.040}{0.14294} = 42.255$$

6. Compute the lead-gear train ratio required to produce an equivalent lead of opposite hand, and select a suitable combination of lead gears to produce this ratio. If the hobbing machine is of the type where the differential is placed after the index train:

$$U = \frac{K}{L} = \frac{25}{42.255} = 0.591646 = \frac{51 \times 29}{50 \times 50}$$

(lead-gear train)

If, however, the hobbing machine is of the type where the differential is placed before the

index train, then, as previously mentioned, the lead-gear train ratio would be found differently. Assuming that such a machine has the same index constant, but a new lead constant K of 0.75, the lead-gear train ratio is found by the following formula:

$$U = \frac{KN_a}{L} = \frac{0.75 \times 150.85706}{42.255} = 2.67762$$

$$= \frac{63 \times 85}{50 \times 40} \text{ (lead-gear train)}$$

Even though the ratio of the lead gears used is not exactly that required to fully compensate for the lead produced by the index-gears, it will ordinarily produce a spur gear having practically no error in tooth alignment. Thus, it is quite often practicable to select gears for the lead train directly from a fraction-equivalent gear table without resorting to extensive calculations to get the exact fractional equivalent. There are some exceptions, of course, such as in the cutting of long spline shafts, where close accuracy on the lead train is desirable.

Incidentally, it should be kept in mind that under no circumstances should the feed be disconnected before an entire cut is completed. It will be noted that the method reduces the calculations to a minimum and saves the time required in cutting an index-gear with slightly helical teeth, which, because of its size, might not fit in the index train of the hobbing machine.

* * *

Copper-Plating of Aluminum

According to information obtained from the Colonial Alloys Co., Philadelphia 29, Pa., aluminum and its alloys can now be copper-plated by the use of a simple preparatory dip at room temperature. The dipping solution can be used in a steel, wood, or ceramic container. There are no fumes and venting is not required. Practically any copper electrolyte can be used for the plating solution, except the sulphate types or those having a high degree of acidity. Copper-plating on aluminum serves as a base for further plating.

* * *

Savings Effected by Cleaning Rusted Diesel-Engine Parts

Running corroded and rusted Diesel-engine parts through an acid wash and alkaline rinse at field overhaul centers at advanced points in the Pacific has saved from 70 to 90 per cent of the parts for reassembly, according to field technicians of the Detroit Diesel Engine Division of General Motors.

Precision Remote Controls

A new line of electro-mechanical remote-control positioning devices, by means of which an operator is able to control a motor-driven mechanism at a distant point in such a manner that the control unit will assume the desired position with extreme accuracy, has been developed by the American Type Founders, Inc., Remote Control Division, 11 W. 42nd St., New York 18, N. Y. These controls are made under the license of the inventor, Michel N. Yardeny, and at present are being used for communication equipment, where rigid tests have indicated their reliability under extreme conditions of temperature, humidity, vibration, and shock. It is claimed that, even under the most adverse conditions, the high degree of accuracy with which these controls function is affected only to a negligible degree.

With these controls, a shaft connected to an electric motor and located out of sight and hearing can be rotated any desired number of turns and fractional parts of a turn, the shaft being positioned with an accuracy of 0.01 degree of rotation. The basic components of the control consist of a torque-delivery unit comprising an electric motor, which can be used to operate any kind of apparatus, and a control transmitter. These two units can be located any reasonable distance apart, it only being necessary to connect them by suitable electric wires.

This remote-control equipment is made in four basic types: First, there is a non-synchronous follow-up control provided with a repeat back indicator for positioning the shaft of a reversible motor during the first or any number of revolutions. Second, there is a multi-turn selector, which comprises a motor-driven device with which the connected load may be placed in any one of several—usually six—adjustable positions over a range of 360 degrees or over any desired number of revolutions.

Third, there is a dual control which incorporates features of both the continuously variable control and the multi-turn selector. By this combination, the operator can position the load to any one of the preset positions or, by turning a knob, to any point over the full range. Fourth, there is an integrating selector, which provides automatic setting of the load to a large number of positions by means of a comparatively small number of push-buttons. Normal accuracy of positioning can be held within 0.01 degree of the output shaft.

The devices are light in weight, small in size, and depend entirely on electro-mechanical principles for their operation. They are built for use on any current characteristics, and are ruggedly constructed to withstand rough treatment, such as they may be subjected to in industrial, marine, aircraft, and electronic fields.

Engineering News

Determining the Effect of Repeated Stresses Quickly

Since an endurance test in actual operation may require as much as five or six years to give reliable results, the Westinghouse Research Laboratories in Pittsburgh have devised testing machines to check more rapidly the new high-temperature alloys used in steam turbines, jet propulsion equipment, and other high-temperature machines. At room temperature, the endurance of a metal can usually be determined after subjecting it to some ten millions cycles of stress, but at elevated temperatures, several hundred million cycles may be required. By means formerly available it took years to submit a sample to, say, 250,000,000 cycles.

The special machines that have been developed can do this testing job in a month. In testing for elevated temperatures, the test piece is clamped in a furnace that maintains the desired temperature. Then, through the clamping structure, stresses are applied 120 times per second by two stator coils connected to a two-phase, 60-cycle supply line.

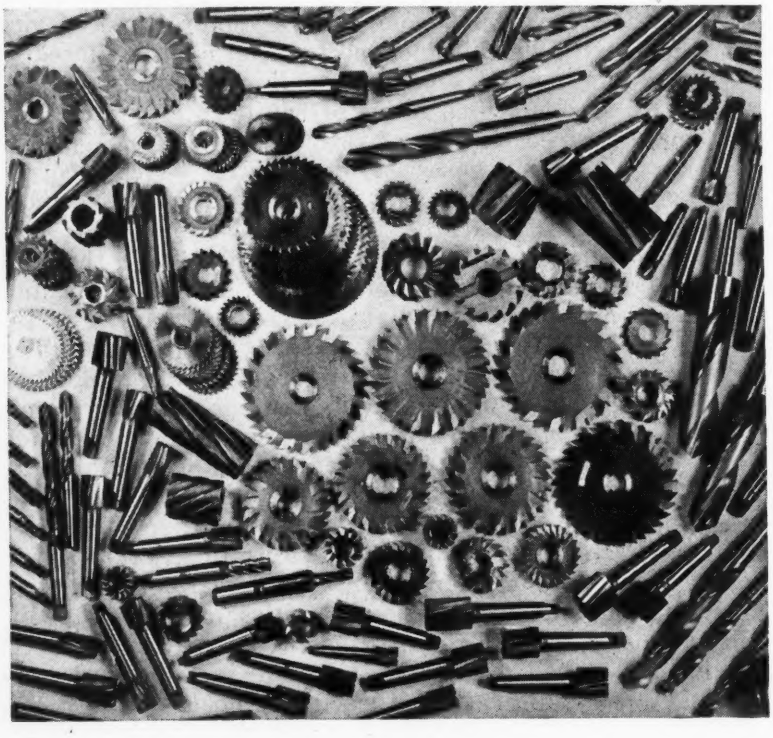
Since research engineers want to record when the first tiny crack occurs rather than when there is complete failure, the testing equipment meets this requirement. When the first crack occurs, the machine automatically stops. Thus, a sample can be placed in the testing machine, heated to the desired temperature, and the test allowed to run day and night without attention for weeks or months until failure begins, after which the machine stops. Tests of high-temperature alloys with one billion applications of stress have been made in 100 days.

High Load Capacity Bearing for Automobiles

High load capacity bearings made of approximately 35 to 40 per cent lead, 4 1/2 to 5 per cent silver, 0.5 per cent iron and the balance copper have been developed by the Ford Motor Co., Dearborn, Mich., for withstanding the heavy stresses imposed by military operations.

Tests indicate that these "Tri-alloy" bearings last three times longer than regular bearings, even when subjected to the most exacting conditions. Some bearings and crankshaft journals used on heavy-duty trucks operated between the Willow Run bomber plant and the Southwest showed no measurable wear after more than 50,000 miles of operation.

When the development of this new bearing was begun in 1943, it was already known that



Part of Hundreds of Worn-out Tools Made from High-speed Steel which would Normally have been Scrapped. To Save Steel, However, They have been Salvaged at the Pittsfield Works of the General Electric Co.

In This "Four-corner" Westinghouse Machine, which has a 20-K.V.A. Transformer at Each Corner, Four Flash Welds are Made Simultaneously in the Fabrication of 150 Metal Frames an Hour from Strip 0.050 Inch Thick. The Operation is Automatic, the Process being Controlled by Two Push-buttons, One for the Air Clamps and the Other for the Electronic Welding Cycle Control

single-face copper-lead bearings were easy to make. Double-face or "floating" bearings, such as connecting-rod bearings, were more difficult, however, because segregation of the lead created weak points. Experiments showed that this segregation did not take place when silver was present.

To produce the new bearing, a novel technique for casting copper-lead bearings, developed ten years earlier, was adopted. This method had been abandoned after the introduction of the cadmium-coated bearing. The use of this technique with the new alloy has resulted in a superior bearing.

More than 500,000 of these new bearings are already in service in armored cars, universal carriers, tanks, jeeps, cargo trucks, and official cars. Patents for the new bearing have been applied for.

Alumon—A New Process for Plating on Aluminum

A new, simple process for preparing aluminum for electroplating, known as the "Alumon" process, has been developed by the Enthone Co., 512 Elm St., New Haven, Conn. According to information obtained from the manufacturer, this new process makes it possible to electroplate all types of aluminum; both rack and bulk work can be processed.

The procedure consists of cleaning in the usual manner and dipping in Alumon solution, which produces an active alloy base that can be subsequently copper- or silver-plated. After the work has been copper-plated, it can be electroplated with other metals, such as nickel, chromium, and gold.

At present, the process is widely used for plating aluminum radar equipment and similar apparatus. Work plated by the process can be subjected to severe distortion without flaking. The plate can be readily soldered. The process is patented, and the user is granted a license with no royalty payments other than the cost of the salts employed.

High-Speed X-Ray Photographs Show Effect of Explosions

High-speed X-ray photographs, taken in a millionth of a second, have, according to Dr. Charles M. Slack, of the Westinghouse Electric & Mfg. Co., added new knowledge on the action of explosions. Photographs made at the Frankford Arsenal in Philadelphia with a quick-acting X-ray tube show that a high-explosive shell expands to twice its normal diameter before it actually bursts. It has also been shown that the blast accompanying the firing of a rifle bullet sometimes reaches the muzzle before the bullet. Accurate photographs have also been taken of the inner structure of golf balls and tennis balls at the moment of impact.

It is stated that this method of photography will prove useful in studying the component parts of valves or other machinery during operation, and in studying the metallurgical changes that take place during an arc-welding operation. To make exposures of a millionth of a second, the X-ray requires a sudden burst of 600,000 kilowatts of electricity.

Industry's Stake in Labor Relations

INDUSTRY'S future is so bound up with productive efficiency, which, in turn, can only be achieved with the active cooperation of the individual workers, that the most important job in the labor relations field of the future is to bring to the individual workers an understanding of some of the "facts of life" involved in industrial operations—facts about which labor has heretofore been largely, if not wholly, uninformed. Without these facts, the workers can hardly be expected to see the fundamental issue clearly and to realize that their welfare, as well as that of the company, is involved in the rise or fall of individual productive efficiency.

WE have heard a great deal lately from industrialists, as well as labor leaders, about the obligation of industry to provide high-level employment in the post-war era. The saying is—"full employment, or else" —meaning that if business and industry fail to do the job, Government will step in and see that it is done. Few, however, have gone beyond that bald statement—they have failed to explain how the Government would do the job, and what far-reaching changes would have to be made in our ways of life in order to accomplish it. The implication is that the high-level employment achieved under a wartime economy proves that similar results can be achieved in peacetime.

THE fallacy of any such assumption is obvious, because of the fundamental difference between wartime and peacetime conditions. Equally obvious to all but the starry-eyed believers in Santa Claus is the fact that high-level employment which depends largely on Government policies can be made possible or impossible by what the Government may do from here on.

ANOTHER point widely overlooked by those who lay the entire obligation for high-level employment on the doorstep of industry is this: Industry, at best, has never furnished more than a relatively small part of the total employment throughout the nation — less than one-fourth. Nevertheless, the obligation remains. It is up to industry to start the ball rolling. Here is an opportunity for constructive and inspiring leadership to head the post-war procession away from depression and to new high levels of industrial employment and living standards.

LABOR relations enter prominently into this picture because so much depends on the individual productive efficiency achieved by each worker. This, in turn, depends on the individual's understanding of his part in the over-all job. He must realize why it is desirable, as well as necessary, for him to step up his efficiency. He must be made to see that his own interests are involved. Slowing up individual production slows up the whole procession, because production and progress are geared together.

HIGH-LEVEL production, which supports high-level employment, obviously cannot be maintained without high-level consumption; and this, in turn, rests on the ability to widen distribution through lower prices of manufactured goods, together with an increase in consuming power through higher wages. The only way these things can be achieved at the same time is by a high-level increase in individual production.

IT is apparent, then, that this thing—individual production—is the hub of the industrial wheel. The whole process turns on it. Unless productive efficiency is steadily increased, all the other things become impossible—high-level employment, higher wages, and a higher standard of living. Without the cooperation of the workers, it is difficult and, in most cases, impossible to increase production efficiency.

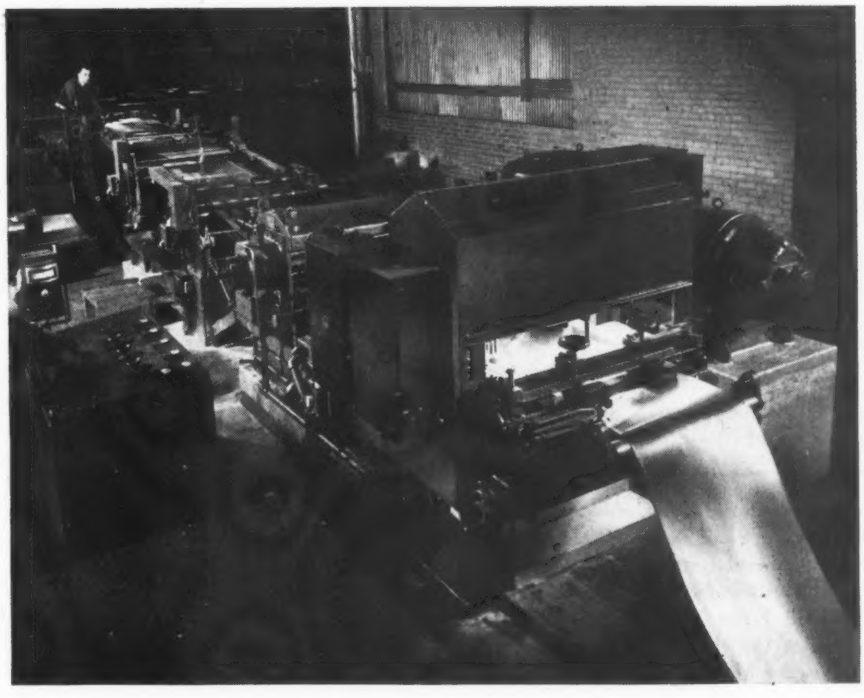
HOW can this cooperation be secured? Perhaps an answer can best be found by looking for the things that discourage or prevent such cooperation, when it comes to stepping up the workers' individual efficiency. There are several of them, and it is easy to see what they are.

THE workers are afraid that by increasing their efficiency they will work themselves and their fellow workers out of a job. Added to this is the suspicion that even if they don't lose their job, their increased efficiency will only help to increase the income of the boss or to swell the stockholders' profits without any comparable benefit to the workers themselves. Nor can they be blamed for having these ideas if they have never been given any facts that will encourage any other belief. How many have ever had explained to them the idea that the earning power of the company and the earning power of the worker are geared together and depend on each other? How many understand that wealth is a tangible thing that has to be created? You can't eat dollars. How many realize that high dollar wages mean little unless the price of the things that the worker needs and wants is kept low?

HOW are the workers in an industrial plant to know these things if no one takes the trouble to bring the facts to their attention? Professional agitators and hostile labor leaders have presented their side of the case, frequently a very distorted presentation. It is for management to present industry's side in a clear-cut manner. If management doesn't take the trouble to give them this information, who else can be expected to do it? It is up to management to get into the minds of the workers the simple fact that the progress of all stems from a common base—increased productive efficiency. Until management succeeds in doing this, the difficulty of increasing individual productive efficiency will continue to be great, and, in many cases, impossible.

HERE is a management job that urgently needs to be done. It is a job that cannot be done for industry by anyone else. It is up to every concern, large or small, to do this job, and do it now.

Electric Eyes Locate Pin-holes in Tin Plate that No Human Eye can Detect. This Westinghouse Pin-hole Detector Automatically Spots, Classifies, and Marks Minute Holes — Less than 1/64 Inch in Diameter — in Tin Plate which Passes by the Inspecting "Eyes" at 1000 Feet a Minute



Improved Arc-Welded Construction

Method of Constructing Forming Dies for Heavy Steel Plate by Arc Welding and the Use of Concrete between Reinforcing Beams—Abstract of an Article Entered in

RECENTLY, our company was asked to bid on the job of fabricating a pressure vessel 42 feet 6 inches in diameter with a 45-degree cone-shaped bottom. The bottom was to be butt-welded to the cylindrical shell and there was to be a reinforcing ring or band of 7/8-inch steel plate entirely around the vessel at the welded joint. The band was to extend up the side of the cylindrical shell and down the cone-shaped bottom, as indicated by the outline of the cross-section through the band at *A*, Fig. 1.

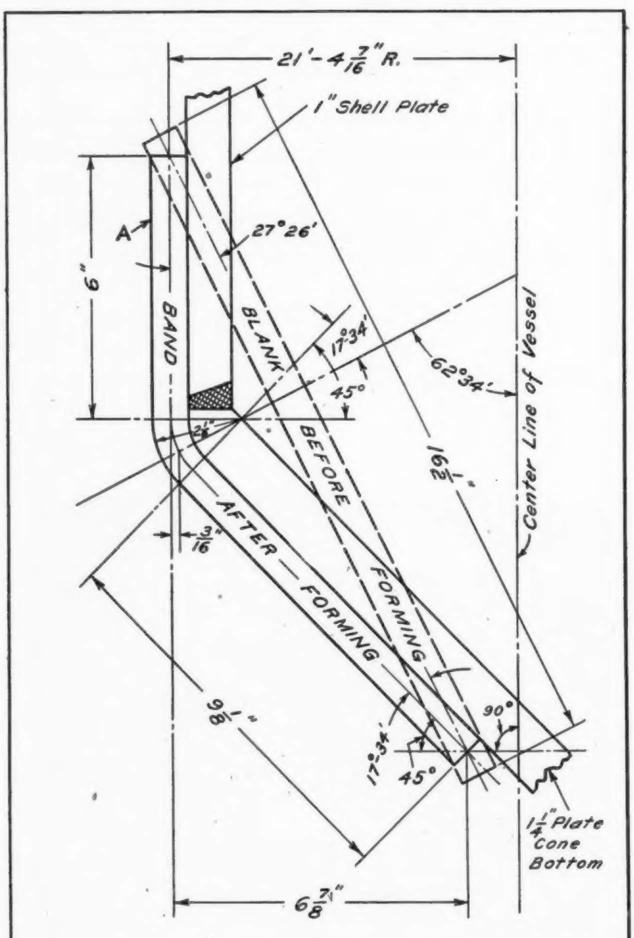


Fig. 1. Outline of Cross-section through Formed Reinforcing Band A and Weld Joining Cylindrical Body and Conical Bottom of Vessel. Segments of Band A are Formed from Blanks such as Indicated by the Dotted Lines in Dies Shown in Fig. 2, the Center Line of the Press Stroke being at an Angle of 62 Degrees 34 Minutes with Axis or Center Line of Vessel

The design and construction of the dies required for shaping the segments of the reinforcing band to the required cylindrical and conical form were carried out as described in this article. The outline of the cross-section of the reinforcing band *A*, Fig. 1, indicates the required shape of the dies, which are shown in Fig. 2. The building of large forming dies of arc-welded steel plate instead of making cast-iron dies had proved economical for simple one-curve dish dies; but the old method of pouring castings for the more complicated shapes had been retained. As difficulty had been experienced in obtaining early delivery of castings, and costs had advanced, it was decided to produce the dies for forming the core-shaped steel plates for the reinforcing band by the arc-welding method. These dies were required to form the segments to a different curve in three different planes.

The general procedure in planning such dies is to lay out a vertical section through the part to be formed, then divide the angle or curve, as the case may be, in such a way that the bending will be evenly proportioned on each side of the dividing line, which becomes the center line of the die working surface and indicates the direction of the press stroke.

Since the dividing line is in line with the press stroke, the base of the die will be established in a plane perpendicular to the line and at such distance from the work as to allow sufficient depth of the die webs to give adequate strength and clearance between the press bed and the curved ends of the work as it passes through the dies.

The die working surface is supported by a series of webs extending radially, as shown in the plan view, Fig. 2. The plan view may be projected from the side elevation, which is the starting point. The sectional view on the curved center line of the plan shows the lateral radius of the die. By positioning each web in section *A–A* normal to the lateral curve, the shape of the working surface of the webs will be identical, and the variation in depth can be calculated. The dimensions can then be given the shop on the working drawings. After the webs are all cut out for both top and bottom dies, and spaced as in the plan view on their respective baseplates, they are welded in position and are ready for pressing the plates that will form the working surface of the dies.

for Steel-Plate Forming Dies

the James F. Lincoln Arc Welding Foundation Annual Program by Walter E. Klauberg, Design Engineer, Wyatt Metal and Boiler Works, Houston, Texas

The plates for the working surface are laid out in the flat to the same shape as the blanks for the reinforcing ring segments, and are formed by first rolling to the lateral radius (see section *A–A*), and then pressing between the webs of the top and bottom die. During the pressing, the working surface plates are moved after each press stroke until all parts of the surface have been pressed directly between opposing webs of top and bottom dies and the shape is even and true. Then they are strength-welded in place to the webs.

Comparatively light plate is used in this type of die, and the space between the webs is filled with concrete. This makes a very economical, yet strong and durable forming die, and allows for the concentrated loads that result when shim plates are used during the pressing operations to iron out wrinkles in the work. The use of the concrete fill provides a solid surface, free from

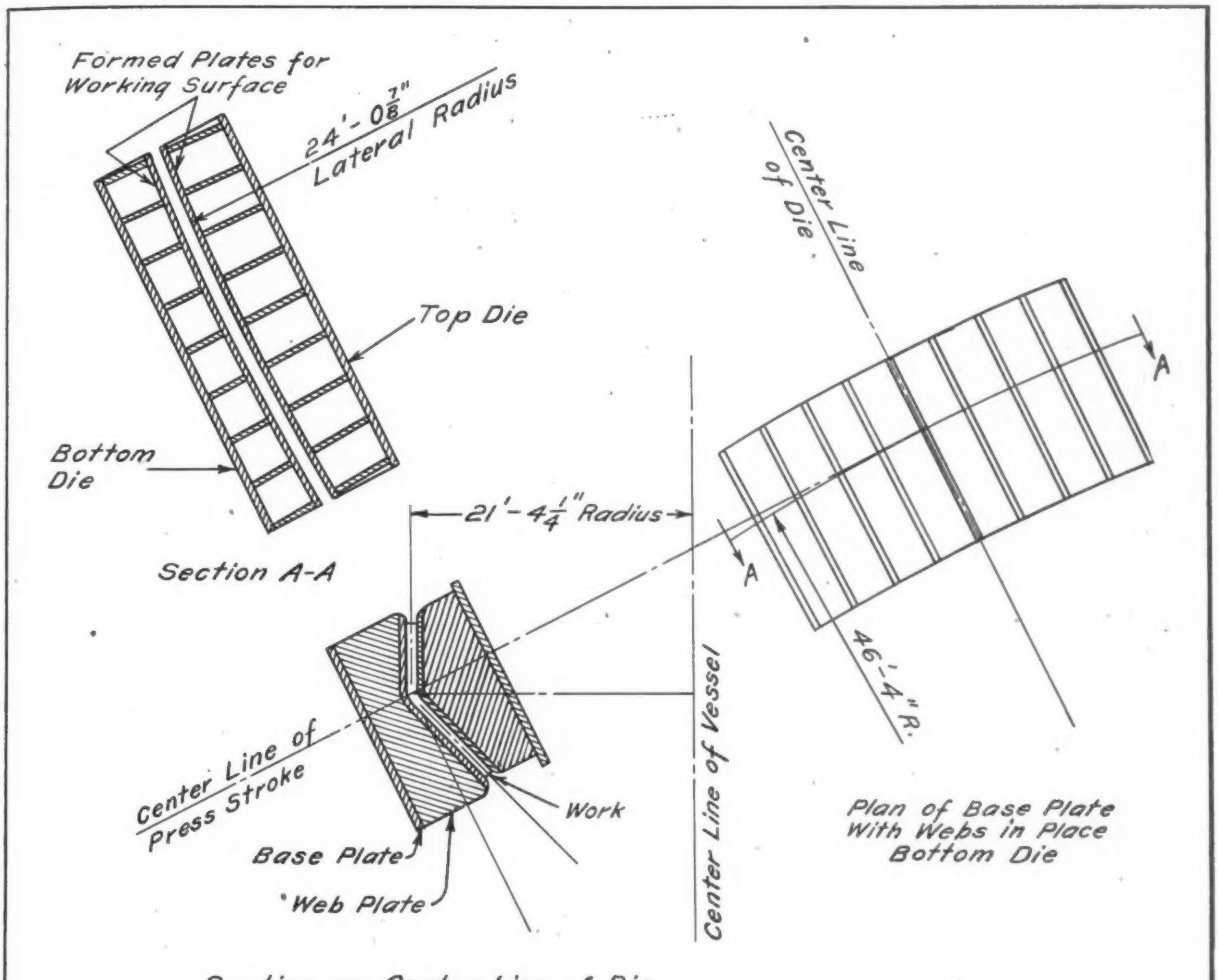


Fig. 2. Diagrams Illustrating Methods of Laying out and Constructing Welded Steel-plate Dies for Forming Segments of Reinforcing Band Having Cross-section Indicated by A, Fig. 1

spring, equivalent to that provided by a cast-iron die. Also, when the welded design is employed, the weight of steel required for the dies is decreased.

The estimated cost of castings for the type of dies described would have been $168, compared with $72.90 for the arc-welded steel dies; thus, the amount saved by using the arc-welded steel construction amounted to $95.10, or a saving of 56.7 per cent. The estimated weight of the cast-iron dies was 1400 pounds, which, at 12 cents per pound, including pattern work and machining, equalled $168. For the welded steel dies, 730 pounds of 1/2-inch steel plate was required, costing 3 cents per pound, which totaled $21.90. Adding to this $1.50 for welding rod, $1.50 for concrete, and $48 for labor, we get a total of $72.90.

Based on the experience with this die, the total annual saving accruing from the use of arc-welded construction in building our own dies would amount to 56.7 per cent of $1610, or $912.87. The increased life and efficiency of the arc-welded steel dies are factors well worth mentioning.

* * *

Plastic Coating for the Protection of Tools and Machine Parts

Plastic coatings have recently been applied to an ever increasing extent for the protection of tools and small machine parts. This increasing use of plastic protective coatings has created an urgent need for low-capacity heating and melting equipment. To meet this need, the Youngstown Miller Co., Sandusky, Ohio, has designed and brought out two sizes of such plastic coating melting equipment. Besides being used to protect small parts or tools prior to shipment, these plastic coatings are employed by several companies to protect precision cutting tools and gages while being stored prior to use.

* * *

Increased Tool Life Due to Using the Right Cutting Fluid

According to the Gulf Oil Corporation, Pittsburgh, Pa., many cases are on record of unusual increases in tool life that can be traced to the use of the best cutting coolant for each particular service. In one instance, a manufacturer of gyroscopes increased the tool life three hundred per cent in the production of aluminum parts on automatic screw machines. In addition, the finish was so greatly improved that a polishing operation was eliminated, and as a result there was a considerable increase in production, in addition to the saving in tool costs.

American Society of Lubrication Engineers Organized

The American Society of Lubrication Engineers has just been organized, with headquarters at 135 S. LaSalle St., Chicago. Lubrication engineers have felt for years the need of a national organization pertaining specifically to their work. In response to this need, the new organization has been formed. The membership will consist of lubricant suppliers and consumers, machinery builders, and representatives of the educational field. One of the aims of the organization will be to promote the teaching of the subject of lubrication in various educational institutions in order to give future engineers and executives a more complete understanding of lubrication problems.

The Society is planning to hold its first national convention at the Stevens Hotel, Chicago, Ill., February 8 to 9. A program of technical papers has been planned by leading authorities on lubrication subjects. The program will be of a varied character to appeal to many branches of the industry.

The officers of the American Society of Lubrication Engineers are: President, C. E. Pritchard, Republic Steel Co.; vice-president, J. C. Peebles, Dean of Engineering, Illinois Institute of Technology; and secretary-treasurer, B. H. Jennings, professor of mechanical engineering, Northwestern University.

* * *

New Slide Films for Teaching Oxy-Acetylene Processes

A series of how-to-do-it slide films, with accompanying instruction literature on oxy-acetylene welding and cutting operations, has recently been completed by The Linde Air Products Co., a unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City. The films and instructions are divided into lessons presenting a step-by-step procedure covering the basic techniques of welding and cutting.

The lessons are arranged in a series, presented as follows: (1) A "cutting" series consisting of eight lessons on connecting, testing, and lighting the oxy-acetylene cutting blowpipe, and on making straight-line cuts; (2) a "welding" series in ten lessons showing how to connect, test, and light the oxy-acetylene welding blowpipe, and giving basic welding instructions for light plate; and (3) a "safety" series consisting of one lesson on the care and handling of equipment and a second lesson on fire precautions.

The slide films and accompanying literature can be obtained through any office of The Linde Air Products Co. at a nominal price.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Safety Relief Mechanisms for Light Drives on Special Machines

A relief mechanism of some type incorporated in the main drive provides the best means of preventing breakdowns of many of the special light machines developed for emergency war production. It is sometimes difficult, however, to design or choose a simple effective device for this purpose that will entail a minimum of changes in existing mechanisms or machines.

The most common safety device for heavy drives is perhaps the copper or brass taper pin which is used in place of the steel pin or the various types of driving keys. The accompanying illustration shows various pieces of mechanism that are capable of adaptation to almost any kind of special machine.

Practically all high-speed special-purpose machines have a number of connecting-rods, link arms, etc., one or two of which can be selected for modification. For example, the usual solid type connecting-rod can be replaced, as shown in Fig. 1, by one made of two parts *A* and *B*. Part *B* is tubular, and is threaded at one end with, say, twenty-six threads per inch to permit a fine adjustment of the operating arm by means of a knurled castellated nut *G*.

The other member *A* is a sliding fit in part *B*. A compression spring, located in part *B*, exerts pressure on member *A*. Two slots *E* are cut 180 degrees apart in *B*, and when this member is adjusted to the correct operating center distance by nut *G*, a pronged cotter-pin *H* is placed across one of the slots in the castellated head of nut *G*.

If the operating movement of the mechanism is obstructed, the arm simply collapses against the pressure of the spring until the mechanism has been freed. The amount by which the connecting-rod can be telescoped is limited by the length of slots *E* and the length of the prongs on cotter-pin *H*. The compression spring must, of course, exert sufficient pressure to operate the drive without yielding when the machine is working under normal conditions.

When the drive to a main camshaft or to a separate mechanism requires a safety relief, the one shown in Fig. 2 can often be used to advantage. On the main driving shaft *C* is a flanged

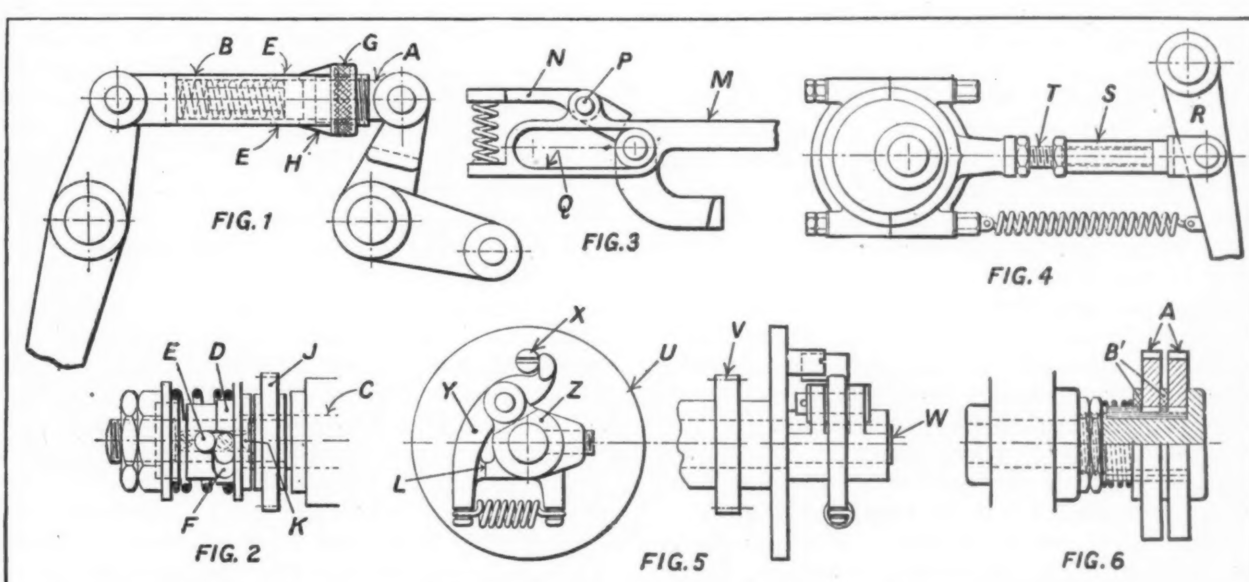


Fig. 1. Safety Device for a Connecting-rod or Link Arm. Fig. 2. Relief Mechanism for a Driving Shaft. Fig. 3. Device to Relieve a Pusher-arm. Fig. 4. Arrangement for Relieving a Cam Rod. Fig. 5. Mechanism for Automatically Disconnecting a Main Drive. Fig. 6. A Drive Relieving Device for Small Torques

sleeve D which is driven by key E, fastened to the main driving shaft. In the flanged sleeve there is an L-shaped slot F in which the projecting ends of the key are a sliding fit. A compression spring tends to force the bottom or end of the longitudinal leg of the L-slot into contact with the pin or key E. Thus the main driving gear or sprocket J is driven by means of pin E and its contact with slot F.

The flange also carries a clutch tooth K which is wedge-shaped, and at the instant the drive becomes excessive, forces the flange against the spring and causes pin E to make contact with the other leg of slot F. The drive will then continue with the sleeve in an inoperative position until the obstruction is removed.

If a relief or safety device for a pusher member, slide, or folders is required, the simple attachment shown in Fig. 3 can be satisfactorily employed. The main cam arm should be replaced by an arm which has a slot Q at the operating end M. A small trigger-like arm N is pivoted about pin P. At the end of the trigger arm is a flared portion into which a recess is drilled to receive a compression spring. The compression spring tends to force the right-hand end of arm N slightly over the boss that carries the pusher, and under normal conditions has sufficient strength to transmit cam motion. If, however, the pusher strikes an obstruction, the pressure causes the right-hand end of arm N to move upward and allow the arm to ride in the slot until the obstruction has been removed.

In a positive cam-driven mechanism, there is always danger of bending an arm and ruining the mechanism. To avoid this, the drive can be changed or replaced by that shown in Fig. 4. In this case, the driven arm R may have a connecting-rod S, and the cam arm may have an adjustable rod T. To introduce a safety device, one of the ends of rod T is threaded and screwed into the cam arm while the other end is left plain and inserted in a long bore in piece S. The two parts S and T are made of steel and are hardened. The bore of part S should be 1/32 inch larger than the diameter of the plain portion of rod T.

The cam arm and the driven arm are pulled together by means of a tension spring having sufficient strength to transmit the necessary motion. If, however, the mechanism becomes jammed, the spring is stretched and the plain portion of rod T reciprocates in the bore of piece S until the obstruction is cleared and arm R is again pulled into its operative position.

The drive for a conveyor or stock-feeding mechanism of a box-making machine, for example, can be safeguarded against breakage by the addition of a slip drive like that shown in Fig. 5. A flange U is fastened to the main driving gear or sprocket V, the whole assembly being allowed to rotate freely upon the drive-shaft W.

Flange U carries one or more pins X. When the positive drive is in operation, one of the pins X engages the drive lever Y, which is pivoted on a pin carried by the driving boss Z, fastened to the main drive-shaft by a set-screw. The driving lever Y is forced into contact with pin X by a tension spring, and stops L are filed to permit proper functioning. If the drive is obstructed, the spring yields and the main drive-spindle is allowed to revolve freely without rotating the driving gear or sprocket.

If the drive is of a lighter nature, such as that for a sheet-feeding device or a dating mechanism, a safety arrangement like that shown in Fig. 6 can be employed. The driving gears A can be made a running fit on the drive-shaft or stud. Each of the side faces of the driving gears comes in contact with the friction disks B, which are preferably keyed to the shaft in such a manner as to prevent rotation and yet allow a sliding motion on the shaft. These gears are forced into contact with the side faces by means of a compression spring adjusted to exert the required amount of pressure for driving the mechanism. Lock-nuts are provided, as shown, for maintaining the required setting. B. M.

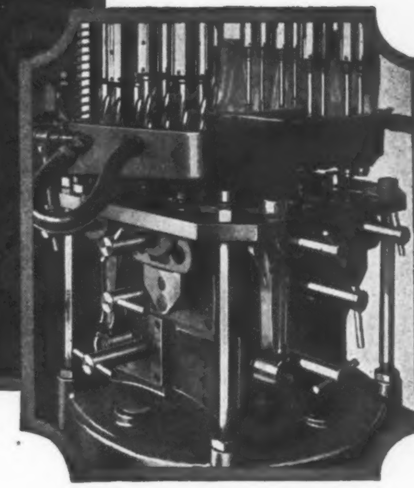
* * *

Preparing Aluminum Surfaces for Spot-Welding

A method for preparing aluminum surfaces for spot-welding to insure sound, strong spot-welds has been developed by Turco Products, Inc., Los Angeles, Calif. This method is known as the "Turco Vulco-Etch." It makes use of solutions of two constituents, Turco L-684 and Turco L-716, by means of which the aluminum surface is made chemically and metallurgically clean. Turco L-684 can be used alone to obtain a chemically clean surface, but when it is used in combination with Turco L-716, a chemically and metallurgically clean surface is obtained. The surface is freed from oxides, salts, grease and oil films, and other impurities that would weaken the weld.

The aluminum surface should be reasonably clean before being placed in the Vulco-Etch solution. For best results, therefore, there should be a pre-cleaning process. While Vulco-Etch will remove grease and oil, excessive amounts of these will contaminate the solution and interfere with obtaining a chemically clean surface. On the other hand, when the work is properly pre-cleaned and degreased, one solution of Vulco-Etch may last for months. When films of oil are observed floating on top of the solution, the solution may be reclaimed by straining it through a funnel filled with wood excelsior. The straining process should be repeated several times, if necessary, until the oil is filtered out.

Design of Tools and Fixtures

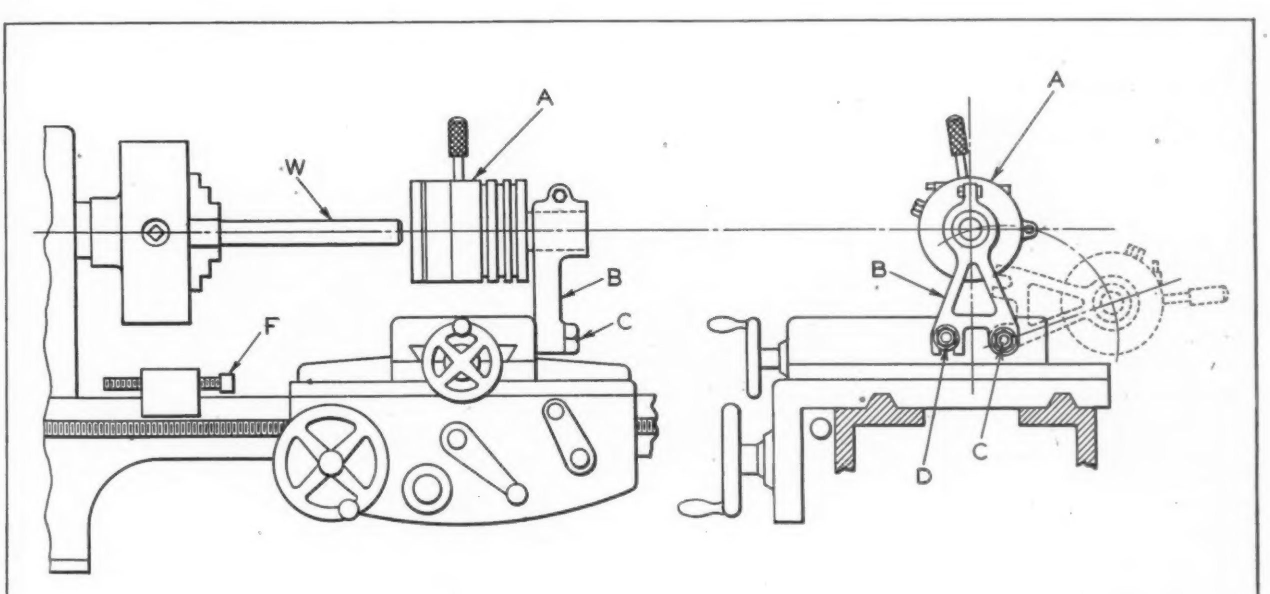


Lathe Set-Up for Cutting Accurate Threads with Die-Head

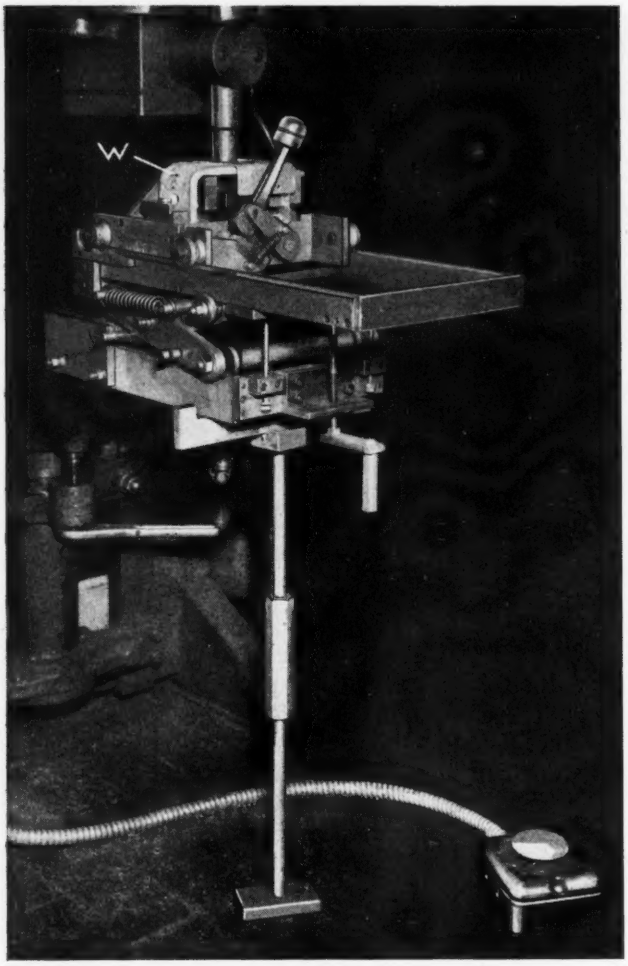
By MICHAEL AXLER, Springfield Gardens, N. Y.

An interesting set-up for cutting accurate threads with a die-head was described and illustrated in October, 1944, MACHINERY, on page 193. The set-up shown in the accompanying illustration was devised by the writer for handling a similar job. This set-up has some advantages not found in the one previously described, and is given here with the hope that it may help others having similar threading jobs. With the arrangement here illustrated the die can be quickly swung back out of the way to permit the lathe to be used for other operations, such as chamfering the end of the piece *W* that is to be threaded. When the die is swung back to the position shown by dotted lines, the carriage and tailstock can be used in the conventional manner.

Die-head *A* is held in the fixture *B*, which is fastened to the lathe carriage with bolts at *C* and *D*. Bracket *B* can be tilted back on the pivot bolt *C*, the bracket being slotted under the head of bolt *D* to permit this swiveling motion. A stop *F* fastened to the lathe bed can be adjusted to control the length of the thread being cut. When the carriage comes in contact with stop *F*, the die continues to travel until tripped, the distance traveled being controlled by the adjustment of the die-head.



Set-up for Cutting Accurate Threads with Die-head Mounted on Lathe Carriage



Spring Table for Spot-Welding

By E. STERN
General Electric Co., Schenectady, N. Y.

The specially designed spring table and fixture shown in Fig. 1 mounted on a 200-kilovolt-ampere spot-welder has made it possible to make two spot-welds on part *W*, Figs. 1 and 2, at the rate of 0.6 minute per weld. This work was previously performed in the conventional manner by loading the fixture on a table at the side of the welder, lifting the fixture over the electrode to weld one spot, then moving it into position for the second weld, and finally, lifting the fixture back on the table for removal of the welded parts. By this method, 1.8 and 2.4 minutes were required for making the two spot-welds. With the new spring type fixture, the complete welding job can be performed by a girl, whereas a man was formerly required.

In designing the table and fixture illustrated, considerable thought was given to the problem of controlling inductance and eddy currents. Proper insulation was provided to prevent heating the fixture or table, which would result in a loss of electrical energy. A large number of the parts were made of brass, as shown by the cross-hatch shading in Fig. 2. Steel parts are so arranged that they will not complete a magnetic field around the electrode at any point.

Referring to Fig. 2, the bottom rails *A* are

Fig. 1. (Above) Spring Table for Spot-welding with Fixture and Work in Welding Position

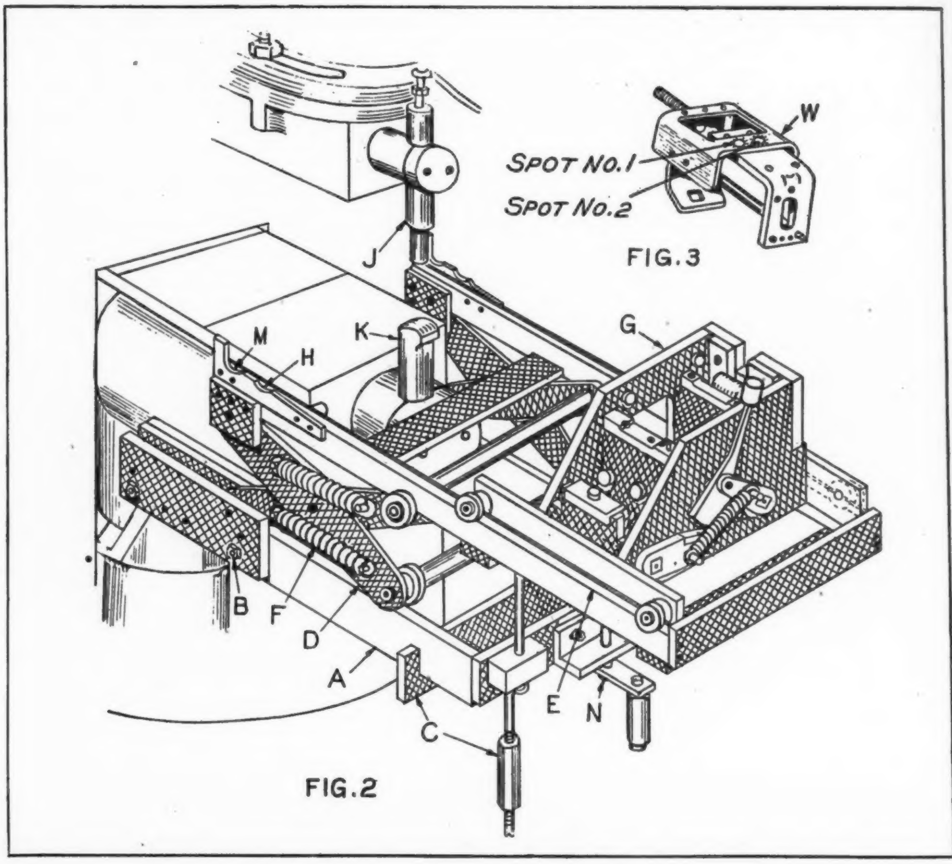


Fig. 2. (Right) Spot-welding Table and Fixture Shown in Fig. 1 with Brass Parts Shown in Diamond-shaped Cross-hatch Shading

fastened to the knee of the welder by bolts *B* and have an adjustable front support *C*. The table also has a platform with top rails *E* and scissor type arms *D*, the corresponding ends of which are fastened to the bottom and top rails *A* and *E*, while their opposite ends are equipped with rollers that engage the rails. The arms are actuated by springs *F*, which serve to raise the platform of the table. Fixture *G* has four rollers by which it is supported on the upper rails *E*.

The parts to be welded are loaded into the fixture, which is then pushed forward until its front wheels are stopped or located in the first notch *H*. This notch locates the work for making spot-weld No. 1. When the machine is tripped, the upper electrode *J* comes in contact with the top of the work in the fixture. As the downward motion continues, the electrode forces both the fixture and table down against the resistance of springs *F* until the bottom of the work comes in contact with the lower electrode *K*. The first spot-weld is then completed and the machine is returned to its open position, permitting springs *F* to raise the table.

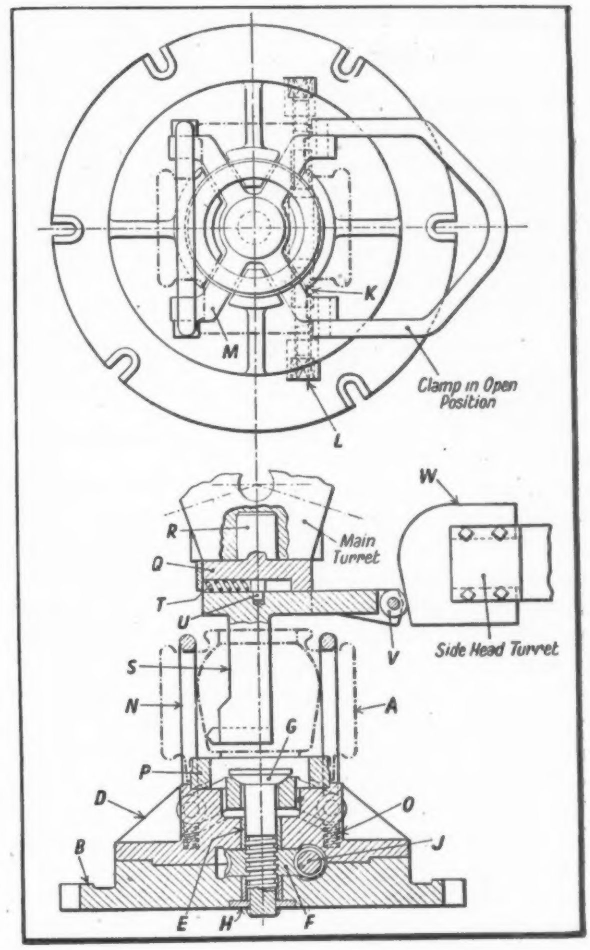
The fixture is now pushed forward again until the front wheels stop in notch *M*, which locates the work for making spot-weld No. 2. After the cycle for weld No. 2 is completed, the fixture is pulled back and unloaded.

This welding table need not be removed from the machine for jobs requiring small light fixtures. The table can be collapsed by tightening screw *N* to make the lower electrode accessible for such work. Many existing fixtures can be used on this table simply by adding rollers with suitable provision for clearance, as required, to permit the fixture to pass over the lower electrode of the welding machine.

Fixture for Profile-Boring and Facing Operations

The fixture shown in the accompanying illustration was designed for profile-boring and facing the steel forging shown at *A*, the base *B* being attached to the table of a vertical boring machine. Casting *D*, machined to fit base *B*, supports the work-holding member. The two members *B* and *D* are bored to receive bushings *E* and counterbored to form a housing for worm-wheel *F*. An Acme thread is cut in the bore of the gear that engages the clamping or draw-in bolt *G*. Keys *H*, fitted into recesses in base *B*, project into grooves milled in the draw-bolt, preventing it from turning and yet permitting it to have a reciprocating vertical motion when actuated by worm *J*.

Two bushings *K* form the bearings for the shaft of worm *J*. One end of the worm has a left-hand thread, while the opposite end has a right-hand thread. The cylindrical nuts *L*, screwed on the ends of the worm-shaft, are machined to take a standard socket wrench, which serves to release and clamp the work. The floating member *M* serves to compensate for any irregularities in the forging. This member rocks in its spherical seating surface under the head of bolt *G*, the clearance around the body of the bolt being sufficient to permit the required equalizing movement.



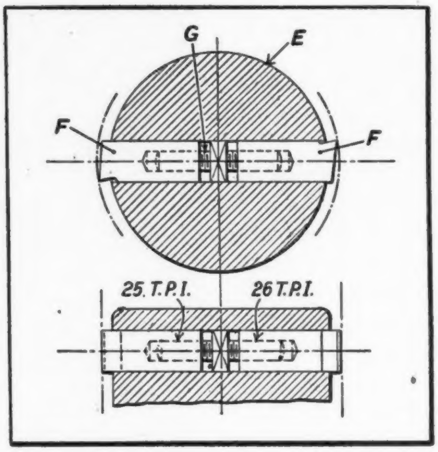
Fixture Used on Vertical Boring Machine for Profile-boring and Facing Forging A

To each point of the X-shaped member *M* are fastened the ends of two U-shaped clamps *N*, which grip the work firmly and also serve as drivers. The springs *O* serve to facilitate the clamping process. Plug *P*, which locates and seats the work, is recessed and secured to casting *D*. Casting *Q* is located in the turret by shank *R*, and is securely fastened in place.

Tool-holder *S* slides in a dovetailed groove in the fixed casting *Q*, adjustment being provided by a gib (not shown). In casting *Q* are grooves which receive springs *T* that press against pins *U* to insure maintaining contact of roller *V* with templet *W*, the form of which is duplicated on the work. The facing cut is obtained by a transverse movement of the turret. B. M.

Adjustable Floating Reamer

An adjustable floating reamer which is proving its worth in practice is shown in the accompanying illustration. It consists of four parts, the bar E, two cutting tools F, and a central screw G. The tools F are of 5/8-inch square section. They are being used in boring a 4-inch diameter hole. The central screw G is made from 5/8-inch square bar stock, and is threaded at each end, a 5/8-inch square collar being left at the center. Each end has right-hand threads, but one end has twenty-five threads per inch, while the other has twenty-six. The differential action obtained with these threads provides a micrometer adjustment.



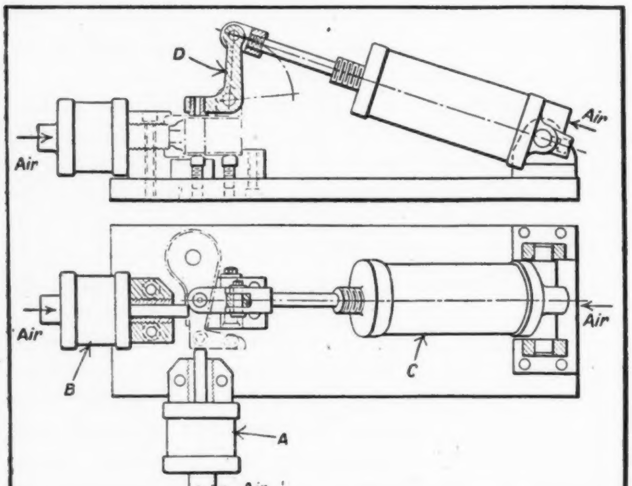
Simple Adjustable Floating Reamer

When the central screw G is rotated in either direction a quarter turn, the change in the diameter of the hole bored by the tool is equivalent to about 0.0004 inch. This is a very fine adjustment, but should a finer adjustment be required, the ends of the screw G could be made with thirty-nine and forty threads per inch.

Longer or shorter center screws used with the same cutters provide for a fair range of sizes. A self-centering device can also be incorporated in this tool.

Drilling a Three-Piece Assembly

In the accompanying illustration is shown a drilling fixture that has been equipped with air-operated clamps to save time in loading and unloading the work. The fixture is employed for drilling a hole through an assembly of three separate pieces for a carbon brush-holder. It carries three air cylinders, and is so arranged that the three pieces are held in the same relative positions that they are to assume in the final assembly when fastened together by a rivet.



Drilling Fixture for Three-piece Assembly

The principal features of this fixture are the two fixed cylinders A and B and the swinging cylinder C, which is hinged at one end, as shown in the illustration. The piston-rod of cylinder C is attached to the hinged member D, which not only exerts clamping pressure on the assembly from above, but also carries the drill bushing. Actuation of a single lever causes all three cylinders to operate simultaneously and clamp the assembly, ready for the drilling operation. A vertical stop-bar is provided to limit the down-feed movement of the drill-spindle. A two-way valve is employed, the return of the pistons to allow the work to be removed being effected by spring pressure.

The clamping action is instantaneous and occurs as soon as the air-valve control lever is operated. When the work has been removed, the cut is cleared of chips automatically by a blast of compressed air. In certain cases, where very rapid clamping might tend to damage the work, it is necessary to slow down the operation of the clamping cylinders. For this purpose, a bleeder valve is inserted in the pipe line at some convenient point.

The bleeder valve consists of a ball which has limited freedom of movement in a tapered bore. An adjusting pin concentric with the bore limits the travel of the ball toward the smaller end. Thus different settings of the adjusting pin provide corresponding differences in the effective passage for the air, and, consequently, control the amount of air allowed to flow in a given time. This arrangement permits the adjustment of the speed at which the clamping cylinders operate. The air cylinders used in the fixture described are a commercial product.

* * *

Corrosion-Resistant Soluble Oil

Protective Coatings, Inc., Box 56, Detroit 27, Mich., has developed a soluble oil known as "Riso," which can be used as a corrosion-resistant agent for all metals. It can be applied either to metals in process of manufacture or as a final dip for blacked steels.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Steel for High-Strength Bolts

H. B. C.—We are seeking information about the kind of steel to use for forged bolts ranging from 3/4 inch to 1 1/2 inches in diameter. These bolts should have an ultimate strength of at least 100,000 pounds per square inch, with good ductility and shock resistance.

Answered by Editor, "Nickel Steel Topics"
67 Wall St., New York City

For the purpose mentioned, 3 1/2 per cent nickel steel is suggested—S A E 2330—the composition of which ranges as follows: Carbon, 0.25 to 0.35 per cent; manganese, 0.50 to 0.80 per cent; and nickel 3.25 to 3.75 per cent. This steel is particularly suitable for high tensile strength bolts. It is used extensively for bolts in the aircraft industry. After the forging operation and prior to machining, it should be oil quenched from 1450 degrees F., followed by tempering at from 1100 to 1150 degrees F. With such heat-treatment, the following average physical properties should be expected: Yield point, 78,000 pounds per square inch; tensile strength, 112,000 pounds per square inch; elongation in 2 inches, 23 per cent; reduction of area, 62 per cent; Izod impact, 75 foot-pounds; and Brinell hardness, 230. This steel is generally available in bar form in warehouses handling alloy steels.

Company's Responsibility for Statements Made by Salesmen

P. F.—Recently we signed a written contract for the purchase of machinery. The contract contained a clause that the company making the sale would not be responsible for any statements made at any time by its salesmen. Now we find that the verbal statements made by a salesman were quite different from the guarantee intended by the company. Could we compel the company to take back this machinery?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Recent higher courts recognize two classifications or kinds of guarantees, namely, expressed and implied. An implied warranty arises when the buyer makes known to the seller the intended purpose of the equipment, and the buyer relies upon the skill and ability of the seller to supply equipment reasonably satisfactory for such purpose. Thus, if a person sells equipment that he believes will not prove satisfactory to the purchaser, he should notify the latter of this fact. On the other hand, if the purchaser explains to the seller the uses to which he intends putting the equipment, the seller may bind the purchaser to an "as is" clause by making a statement to this effect in the contract. It must be realized that even a written clause of this nature will not relieve a seller of responsibility for fraudulent verbal statements made by a salesman. In the case of Southwestern, 139 Fed. Rep. (2d) 204, testimony proved that a salesman made a definite and positive verbal guarantee regarding machinery. Later the salesman and the purchaser signed a written contract which contained a clause providing that it was understood that all previous verbal guarantees were cancelled and not effective.

The higher court indicated that this clause in the written contract could not relieve the seller from responsibility for fraudulent statements by his salesman. It is quite apparent, therefore, that no written contract can relieve a manufacturer from responsibility for fraudulent statements made by his salesman. Of course, the Court will decide whether the statements made by the salesman actually were fraudulent.

* * *

Solving a Soft Metal Fastening Problem

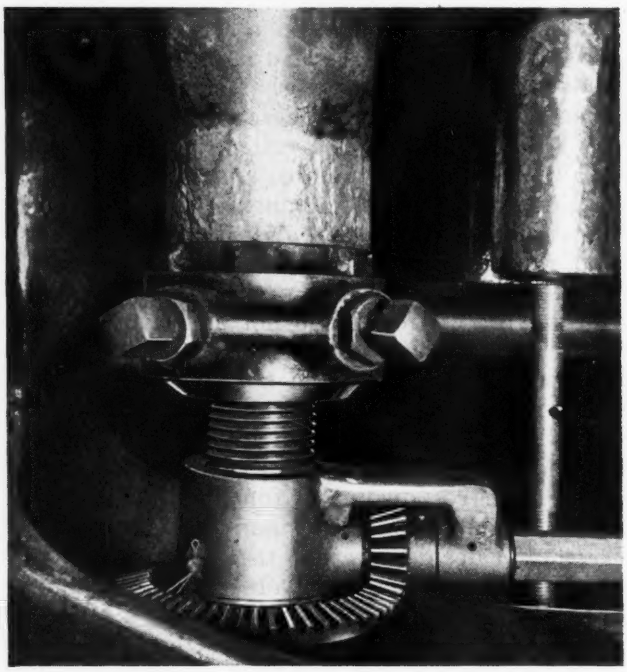
The motor for actuating the cowl flaps and air cooler flaps on one of the types of military aircraft requires a rigid mounting in the plane. Since the metal of the mounting boss is too soft to be used for permanent fastening, Rosan locked-in inserts were used to give the metal the required strength. The Rosan inserts, made by Bardwell & McAlister, Inc., Hollywood, Calif., according to the Dumore Co., the manufacturer of the motor, greatly simplified the production of the motor and made the installation much more durable. The insert does not turn or loosen under vibration or torque. It can be removed or replaced without disturbing the parent material by performing a simple shallow drilling operation.

Repair of Cast-Iron Punch-Press Pitmans

By C. STRAYLEE
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

The use of bronze deposited by arc welding to repair the cast-iron pitmans on punch presses has resulted in a considerable saving of labor and materials at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. Formerly, when the threads were stripped, the pitman was cut off above the stripped section. An entirely new piece was bored, turned, and threaded, and then welded to the pitman.

By the new method, half of the pitman is cut off. The threads are removed with a chisel, and



Punch-press Pitman that has been Repaired by Welding

the two parts are built up by the deposition of bronze; then they are drilled, the thread cut, and welded back on the pitman. Finally, a clamp is fitted over the piece and bolted into place. On some pitmans, there is a removable cap; in such a case, it is not necessary to cut off the end. Instead, the cap is removed and built up by bronze deposition.

This method not only saves material that was formerly scrapped, but it also saves a considerable amount of machining time. The bronze deposit is as strong as the original metal. The method has proved so successful that it is now being extended to the bushings on the pitmans, which are built up by welding, after which they are machined.

Effects of Long Working Hours on Production

The Bureau of Labor Statistics of the United States Department of Labor has made quite a thorough study on the effect of long working hours in a number of industrial plants. In a study that covered six plants, it was found that one of the most immediate effects of lengthening the working hours was an increase in absenteeism.

Generally speaking, there was little difference in the absenteeism rates in a five-day week and a six-day week as long as the daily hours did not exceed eight. However, when the daily hours were increased to 9 1/2, absenteeism nearly doubled, even though, in that case, a five-day week was substituted for a six-day week, so that the weekly hours were actually reduced from 48 to 47 1/2.

A subsequent increase in hours from 47 1/2 to 55 1/2, adding a sixth day of 8 hours, was associated with a still higher rate of absenteeism, particularly on Saturday. This finding in one plant was corroborated by the experience in another plant, when the number of weekly working hours was raised from 48 to 58. On the other hand, absenteeism decreased when the number of working hours was reduced.

The information available on the relation of accidents to number of hours of work is rather fragmentary, but in one plant the time lost due to injuries was twice as great when the work week was 58 hours as when it was 48.

As regards production in general over an extended period of time, the workers produced less per hour of work when the schedule was increased above 40 hours per week. However, there were exceptions to this rule. In two cases, the average hourly efficiency was about the same when the work hours were 58 and 60 hours per week as they were when the schedule was 45 hours.

The total output per man-week, however, was, as a rule, greater when the number of hours was increased, with one important exception. In that instance, the total output was greater for a 47 1/2-hour schedule on a five-day week than for a 48-hour schedule on a six-day basis. In another plant, the total output was fully as great under a 52-hour schedule as it had been under a 58-hour week. This makes it difficult to generalize or to draw definite conclusions.

* * *

"It is well worth remembering that it is much easier to disorganize an activity than it is to organize one to take its place. Many critical folks—some of them critical of industry—overlook that."—*C. E. Wilson, president of General Motors Corporation*

Simple Equipment for Broaching and Sizing Square Tubing

A NEW method of sizing and removing burrs on the inside of square, tubular steel frame members has been devised at the Schenectady Works of the General Electric Co. The new method is said to do a better job and do it much faster than any previously employed. The square, tubular frame members handled by this method have outside dimensions of 1/2 inch and walls 1/32 inch thick. They are cut in 19-inch lengths and then drilled in several places. The drilling causes burrs at each break-through point on the inside of the tube.

One end of the tubular frame member accommodates a steel shank which must fit snugly into the opening at a point where a burr has been produced by drilling. This burr, which is located approximately 1/2 inch from the open end of the frame, must be removed and the opening must be properly sized, since the dimensions of the square, tubular stock vary slightly.

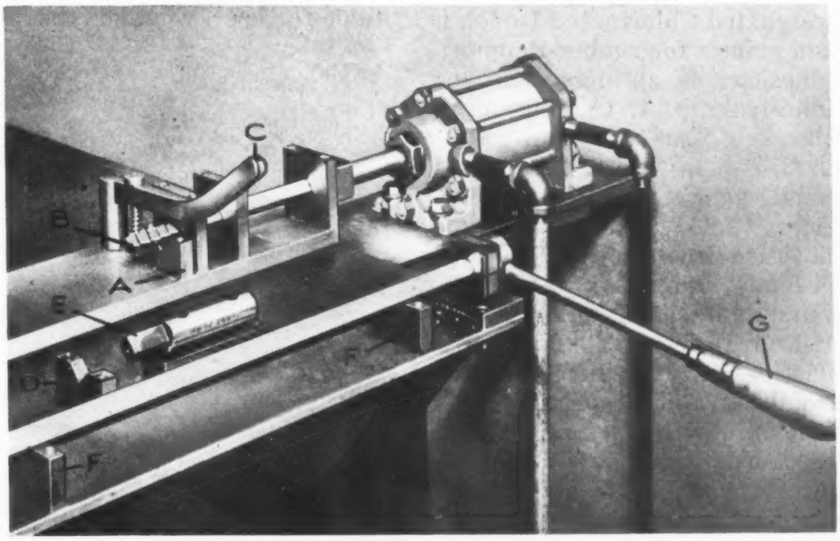
Considerable difficulty was experienced with the previous methods used for removing the burrs and sizing the tube, the operations being rather slow and expensive. With the new method of processing these tubular frame members, V-blocks are mounted on a steel table, as shown in the accompanying illustration, to position the piece for the burring and sizing operations. The V-block *A* serves to locate the tubing so that its open end will slide over the broach *B*, which is also mounted on the table. Broach *B* is approximately 1/16 inch smaller than the opening in the tube. The tube or frame member is held firmly in place by a hand-operated lever *C* which, when depressed, exerts a downward pressure on the work at a point above the burr, wedging or forcing it against the broach. The broach is then withdrawn quickly from the piece, so that its cutting edges shear off the burr. The broach is driven by air pressure, regulated by a two-way pneumatic cylinder, which is controlled by a foot-operated valve.

Another set of V-blocks, one of which is shown mounted on the table at *D*, serves to position the frame member so that it can be slid over gage *E* (also mounted on the table), which checks the size of the open end of the tubular piece. A third set of V-blocks *F* locates the part for sizing the open end of the tubing if it is found to be under size. The sizing device is a cam type expansion tool operated by hand-lever *G* which, when fully depressed, causes the tool to expand to the required inside dimensions of the tubular frame member. The work is positioned over the expansion tool in the same manner as for the broaching and gaging operations.

* * *

New Coolant Compounds

Two new coolant compounds have recently been placed on the market by Clearlube Products Co., 1912 Book Tower, Detroit 26, Mich. One of these compounds, Clearlube Aqua-Cut, is water soluble; the other, Clearlube Petro-Cut, is soluble in oil. Because no free sulphur or fatty acids are used in the basic compounds, these products are said not to break down, become rancid, or undergo any chemical changes due to pressure, speed, heat, or length of use. Both compounds also provide a rustproofing film.



Equipment Used by General Electric Co. for Removing Burrs, Gaging, and Sizing Inner Surfaces at Ends of Square Tubes

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

A Water Soluble Metal Cleaner for Ferrous and Non-Ferrous Metals

A water soluble metal cleaner, known as "Swirt," has been developed by the Phillips Chemical Co., W. Touhy Ave., Chicago 45, Ill. This compound efficiently removes all types of soil, including grease, buffing compounds, cutting and machining coolants, and oils. The compound is neither acid nor alkaline, and will not etch or pit ferrous or non-ferrous metals and alloys. It has a high flash point of 155 degrees F., open cup. An added feature is that no dangerous or disagreeable vapors which might injure or annoy the operator are given off.

"Swirt" may be used in practically any type of container—from a bucket to a thermostatically controlled heating tank or degreaser. The cleaning operation involves a single rinse in the solvent, which is followed by flushing with plain water. 201

Chlorinated Isopol Offers Advantages of Chlorinated Rubber

A new synthetic that is closely comparable to chlorinated rubber in flame resistance, moisture resistance, chemical resistance, solubility, stability, and compatibility with plasticizers has been brought out by the Union Bay State Chemical Co., Cambridge, Mass. The new compound, designated Chlorinated Isopol, is suitable for use as a primer for rubber-to-metal adhesion; as an ingredient in adhesives, paints, lacquers, inks, etc.; as an acid- and alkali-resistant coating for metal, concrete, and other surfaces; for fireproofing and moisture-proofing fabrics and other materials; wherever sound and heat insulation qualities are desired; and as a plastic wherever inertness to chemicals and fireproof properties are of importance. Fair-sized orders can now be filled, but the material is not yet in quantity production. 202

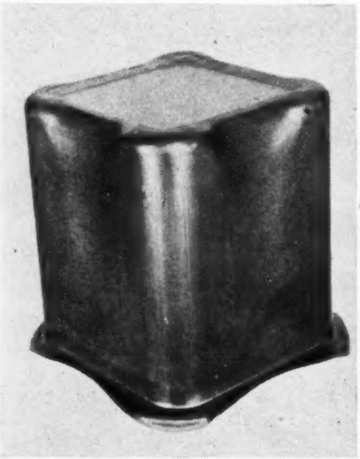
"Nopco 1692" – A Rust and Corrosion Inhibitor

A rust and corrosion inhibitor called "Nopco 1692" has been introduced on the market by the National Oil Products Co., Harrison, N. J., for use in metal-working industries. After being dipped in this compound, machine parts are dried for thirty to thirty-five minutes. The evaporation of the solvent leaves a soft, greasy, protective film. Wet articles may be immersed in Nopco 1692, since any water adhering to their surfaces is quickly displaced by the inhibitor. Steel plates coated with this compound have withstood corrosion for over 200 hours in a standard humidity cabinet, and for 84 hours in a salt spray cabinet. 203

Deep-Drawing Alloy Steel Facilitates Vitreous Enameling

White and other colors of vitreous enamel can be applied directly to a new steel known as Inland "Ti-Namel" steel without the prior application of a base or ground coat enamel. This steel is a development of the Inland Steel Co., 1270-33 S. Clark St., Chicago 3, Ill. The enamel, when properly applied, does not blister or become marked by black specks or fish-scale. Satisfactory finishes are obtained with a thickness of from 0.006 to 0.009 inch, depending upon whether the application is for an interior or exterior part.

This steel has excellent drawing properties, and can be used for drawing many parts heretofore formed and welded. Another important property is that it does not age-strain, so that neither special temper rolling nor roller leveling to prevent strain lines is required. Still another quality



This Container is Formed in Three Operations without Intermediate Annealing from Inland Ti-Namel Steel. Its Size is 12 by 12 Inches by 13 Inches Deep

To obtain additional information on materials described on this page, see lower part of page 188.

of this steel is that shallow panels of large areas, such as stove end panels, remain flat and true to the required shape and form after drawing operations.

This steel also has great resistance to sagging. In 18-gage material, practically no sagging was evidenced, as against 0.25 inch sag for standard enameling iron. In 24-gage material, this steel had only 0.30 inch sag, as against 0.80 inch sag for standard enameling iron..............204

Aluminum Surface Cleaner for Spot-Welding

A new method of rendering aluminum surfaces chemically and metallurgically clean in preparation for spot-welding has been developed by Turco Products, Inc., of Los Angeles, Calif., and Chicago, Ill. This method makes use of Turco "Vulco-etch," a chemical bath which frees aluminum alloy surfaces of oxides, corrosive salts, and tenacious grease and oil films. Cleaning and etching are accomplished in a five- to twenty-minute dip in the Vulco-etch solution, using unheated wood-lined, rubber-lined, or crockery tanks. 205

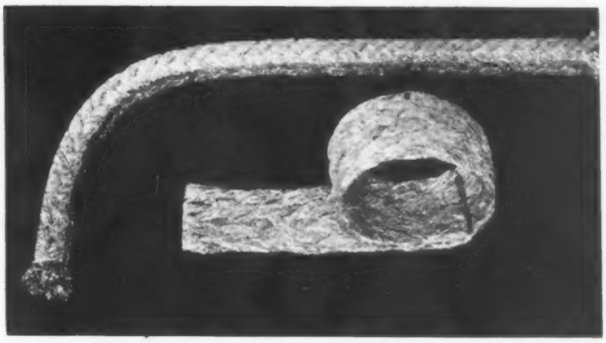
New Treatment for Plastic and Rubber Molds

A new treatment for molds used in plastic and rubber production, known as the Moldeze treatment, has been developed by Protective Coatings, Inc., Box 56, Detroit 27, Mich. This treatment has been used with satisfactory results for several months. Moldeze is a liquid that prevents adherence of the molded material to the mold. It is said to give a smoother, more brilliant finish to the molded part, and to inhibit rust, helping to maintain molds in good condition when not in service.

The molds are treated a few times at close intervals until the surface of the metal in the mold has "absorbed" the liquid, after which the treatment is given only when it is required. The liquid does not build up a coating or film on the mold. 206

Flexible Metallic Packing Withstands Corrosion and High Temperatures

A new type of flexible metallic packing which is capable of withstanding temperatures up to 2000 degrees F. and is highly resistant to corrosive gases, alkalies, and most acids has recently been announced by Johns-Manville Co., 22 E. 40th St., New York 16, N. Y. This product, known as "Inconel" packing, was developed to meet the destructive conditions existing in the exhaust systems of airplane engines equipped with turbo-superchargers.



Braided Wire Mesh Packing, Made of a Nickel-chromium-iron Alloy and Developed for Airplane Engine Exhaust Systems, is Now Available for Industrial Use

Inconel packing is made of a nickel-chromium-iron alloy in wire form, which is first knitted into mesh and then braided. In addition to its high corrosion and temperature resistance, the new packing is strong, resilient, and both non-scaling and non-magnetic. It is available in a number of styles, including square-section packing in coil and tape forms from which ring type gaskets may be formed. One style, made with asbestos fibers interwoven with the metallic alloy, serves as a sealing agent............207

Substitute for Petroleum Sulphonates in Soluble Oils

A substitute for petroleum sulphonates or "mahogany" soaps used in making emulsifiers and soluble oils is Gunk Concentrate P-96, a compound manufactured by the Curran Corporation, Malden, Mass. In use, the concentrate is diluted with about three volumes of a suitable mineral oil, and is then extended further with water, as needed, to produce stable milky emulsions for cooling and grinding operations. 208

Belt Dressing for Synthetic Rubber Belting

Standard dressings for rubber belts which have proved satisfactory on belting made from natural rubber will also prove effective when used on GR-M synthetic rubber belts, according to a recent bulletin issued by the B. F. Goodrich Co., Akron, Ohio. The synthetic belts will not absorb the dressing as quickly as natural rubber, and care must be taken not to apply more dressing than necessary, as this may result in slippage. The proper use of dressing, however, will allow the belt to deliver a greater horsepower and to operate under a load with less tension than a belt without dressing..........209

To obtain additional information on materials described on this page, see lower part of page 188.

General Electric Method of Designating and Inspecting Surface Finish

IN a paper prepared some time ago by Walter Mikelson of the General Electric Co., the author emphasized the need for a practical, rapid, and reliable method of designating machine surface finishes. To successfully meet surface finish requirements, a clear understanding of surface finish conditions is needed. The engineering, designing, and production departments must be sure to talk about the same thing when they discuss surface finish. An approach to this problem which the General Electric Co. has used for several years is that of defining these finishes with the aid of actual finished sample specimens. This method has been found valuable in maintaining quality at low cost.

Practical instruments are not yet available which adequately measure all the characteristics of a surface. More research work remains to be done before the importance of these characteristics can be evaluated. In the meantime, some simple practical method is needed to specify surface finish in design and production.

The General Electric system makes use of sample specimens for this purpose. In many respects, it is similar to a system that has been developed by the Army Ordnance Department, except that the symbols describing the specimens designate a specific value of surface roughness rather than a wide range of values for various applications.

The symbol used is an "f" with an attached number, for example, f^1, f^2, f^3. There are ten degrees of roughness, varying in 2 to 1 steps from 4 to approximately 2000 micro-inches r.m.s. Each symbol may apply to one or more sample finishes, but all are machined to the same smoothness on a metal specimen block to illustrate differences in surface characteristics encountered in practice. For example, two surfaces are represented on the smoothest specimen, one of which is lapped and the other honed.

These specimens are available to design engineers, draftsmen, shop mechanics, and inspectors. They are used:

1. To indicate to the design engineer and to the draftsman the smoothness and appearance of various degrees of finish, and to permit the selection of an exact degree of smoothness for the functional purposes intended.

2. To enable the shop mechanic to visualize the degree of smoothness that is designated on a drawing.

3. To enable the shop mechanic and inspector to inspect the product surfaces by comparing them with the proper sample specimen.

The method of designation of surface finish on a drawing may require some explanation. The proper "f" symbol is applied to the surface to be machined. The "f^5 uncut" designation, for example, means that the specified degree of smoothness is to be obtained in the process of molding, casting, forging, punching, etc., without machining. In general, the method of machining is not specified. When this is necessary, however, the method is added to the numeral, for example, "f^4 buff."

In the inspection of machined surfaces, the mechanic and inspector compare the finished surface with the sample specimen which most nearly approaches the appearance of the machined product. The method of inspection in all cases consists of comparison by sight and feel with the standard surface. When finishes are required that differ widely in appearance from the standardized samples, special samples or gages are made up. They are numbered in the same manner as the standard set.

The continued use of this system for the last ten years has accelerated production planning and tooling and promoted uniformity and interchangeability of parts at minimum cost and delay. It is a practical step for present production needs, and is offered as a suggestion to those who may have similar surface finish designation and inspection problems to solve at this time. The merit of the method lies in the fact that it accurately portrays many of the characteristics of a surface. A sample-finish specimen is actually representative of the finished product, and hence is most useful to design and production personnel, and is simple to interpret.

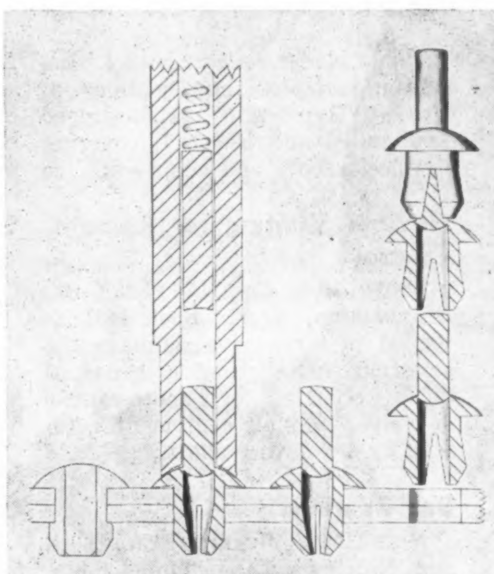
* * *

The importance of industry having available the necessary special machine tools for reconversion before the day of reconversion actually arrives cannot be over-emphasized. If only two or three machines are missing out of an automobile plant production line, it may mean that thousands of machines will stand idle and tens of thousands of workers will remain unemployed for a much longer period than otherwise would be necessary. If the government bureaus that now control matters of this kind do not quickly take action, it could easily happen that for the want of a few machines, the whole job of quickly reconverting an automobile plant and re-employing its thousands of workers would be delayed for months.

Plastic Blind Rivet

A new plastic blind rivet so designed that it can be applied by one man in a single operation of a rivet gun has been brought out by the Plastic Development Division of the Victory Mfg. Co., 1105 Fair Oaks Ave., South Pasadena, Calif. The design of this "Des-Rivet," as it is called, is based on a wedging action, and takes full advantage of the flow characteristic of plastic materials under pressure. The rivet, molded in one piece, consists of a head with a plug attached by a thin breakaway section and a tapered shank split to form four tapered fingers. The shank and head are hollow and of the same diameter as the plug.

The new type rivet is applied, as shown in the illustration, by pressing the tapered fingers into a drilled hole. Taper on the outside diameter of the fingers reduces the inside diameter of the shank, the rivet and work being held in place by the pressure of the depressed fingers. Impact from the rivet gun, which may be operated either by air or manually, instantaneously shears the plug and drives it into the plastic shank until the plug is flush with both ends of the rivet, maintaining the contour of the rivet head and completing the installation in a single operation.



Views of Plastic "Des-Rivet," Showing Rivets before and after Application

The wedge action of the plug in the tapered shank expands the fingers against the walls of the drilled hole and upsets the shank end of the rivet. The rivets may be inserted singly or assembled in "sticks" by inserting the undriven plug of one rivet into the shank of another. An automatic rivet gun is available to accommodate sticks of rivets, making installation very rapid.

* * *

First Company to Receive Army-Navy Award Adds Fourth Star

The Cleveland Twist Drill Co., Cleveland, Ohio, was the very first company in the country to receive the Army-Navy Production Award. This fact makes it all the more impressive to note that this Award has now been renewed for the fourth time, enabling the company to fly the Award flag with four white stars.

Neoprene-Fiberglas Conveyor Belts

Longer life for rubber-fabric conveyor belts subjected to severe operating conditions is forecast by the performance of experimental Neoprene-coated Fiberglas fabric belts, made by the B. F. Goodrich Co., and tested on a factory conveyor line operating continuously for twenty-four hours, seven days a week. The temperature of the material carried by the belts averages 300 degrees F. The belts are subjected to a considerable flexing, and are exposed to contact with oil used in the binder of the material carried. The average life of rubber-covered cotton belts in this service has been six weeks. Neoprene-Fiberglas belts, 3/16 inch thick and 4 inches wide, have operated for many times this period.

Out of eight belts, six are still performing efficiently at the end of seven months' service. One belt was burned through by a piece of red-hot material after three months' service, and a second belt failed at the end of six months because of extreme stress produced by an operating difficulty. In addition to the long service of the belts that did not meet with any unusual accidents, the high resistance to elongation of the Fiberglas fabric practically eliminates the necessity of making any adjustments to keep the belts in even tension.

* * *

New Industries Create Employment

According to Stevenson, Jordan & Harrison, Inc., management engineers, industries that are today producing probably one-half of our industrial output in peacetime did not exist or were of little importance fifty years ago. They came into existence and grew in size because new and useful products were designed or developed. New methods of manufacturing were also developed or old methods were so improved that new industries were built around them. As a result, employment increased and the demand for labor caused wages to increase in a ratio more than twice as fast as the average cost of the goods required for the well-being and comfort of our population.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 187 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the February Number of MACHINERY

Rapid Photographic Reproduction

OZALID DIVISION OF GENERAL ANILINE AND FILM CORPORATION, Johnson City, N. Y. Circular descriptive of Ozalid "Rapid Black" and "Dryphoto" papers for quickly reproducing anything drawn, typed, printed, or photographed on translucent material. 1

Electrical Equipment

GENERAL ELECTRIC Co., Schenectady 5, N. Y. Bulletin GEA-4246, descriptive of electric equipment for arc furnaces. Bulletin GEA-4317, descriptive of high-voltage direct-current supply equipment. Circular GEA-4140, describing vibration-measuring equipment and its use. 2

Ready-Cut Die-Blocks, Punch Plates, etc.

TOOL CRAFT Co., 1835 Westchester Ave., New York 60, N. Y. Circular 1001, covering Toolcraft ground tool steel, ready-cut die-blocks, punch plates, and stripper plates designed to help toolmakers and diemakers standardize and simplify their operations. 3

High-Pressure Die-Casting Machines

LESTER-PHOENIX, INC., 2711 Church Ave., Cleveland, Ohio. Circular announcing two new Lester-Phoenix high-pressure die-casting machines, one for zinc, tin, and lead, and the other for aluminum, brass, and magnesium. 4

Adjustable-Blade Cutters

WEDDELL TOOLS, INC., Rochester 7, N. Y. Circular illustrating and describing Tri-Bit cutters with adjustable blades. Also Sheet 4, containing complete specifications of Tri-Bit "Hyper-Mill" carbide-tipped face mills, and Sheet 7, covering flywheel arbors and adapters. 5

Flexible Shafting for Remote Control

STOW MFG. Co., 15 Shear St., Binghamton, N. Y. Book 449, intended to serve as a guide in the selection, installation, and use of flexible shafting for remote control of valves and all equipment actuated by a rotating shaft. 6

Ball Bearings

NICE BALL BEARING Co., 30th and Nicetown Lane, Philadelphia, Pa. Catalogue 116, covering the complete line of Nice ball bearings, including radial, thrust, and combination type, as well as ball-bearing sheaves and wheels and special type ball bearings. 7

Precision Grinding

BLANCHARD MACHINE Co., 64 State St., Cambridge 39, Mass. Booklet entitled "Work Done on the Blanchard," showing examples of the machining and finishing of flat surfaces to a high degree of accuracy on Blanchard grinders. 8

Surface-Roughness Measuring Equipment

PHYSICISTS RESEARCH Co., Department 2, Ann Arbor, Mich. Catalogue covering in detail the profilometer equipment made by this concern for measuring surface roughness. 9

Rust Prevention

E. F. HOUGHTON & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. Publication entitled "Rust—Causes and Prevention," containing a comprehensive discussion of cleaning methods, choice of corrosion preventives and application, etc. 10

Carbon and Graphite Products

NATIONAL CARBON Co., INC., 30 E. 42nd St., New York 17, N. Y. Catalogue Section M-8000-A, covering carbon and graphite products for use in the mechanical, metallurgical, electrical, and chemical fields. 11

Welded Steel-Plate Construction

CENTRAL BOILER & MFG. Co., 5818 Rivard St., Detroit 11, Mich. Circular outlining the advantages of welded steel-plate fabrication in building machine tool bases, columns, and frames. 12

Vertical Boring and Turning Mills

CINCINNATI PLANER Co., Cincinnati, Ohio. Bulletin 176, illustrating and describing Cincinnati Hypro vertical boring and turning mills. 13

Gas Cutting Tips

AIR REDUCTION SALES Co., 60 E. 42nd St., New York 17, N. Y. Bulletin ADG-2008, describing Airco 45 and 45M high-speed machine gas cutting tips, which control the expansion of cutting oxygen. 14

Heat-Treating Machinery

SELAS CORPORATION OF AMERICA, Philadelphia 34, Pa. Bulletin 451-B, illustrating and describing production-line heat-treating machinery employing a new gas-combustion technique. 15

Electric Etching Machines

George Gorton Machine Co., 1301 Racine St., Racine, Wis. Bulletin 1635-B, describing the Gorton complete line of tracer-controlled electric arc etchers, made in single and multiple head types. ...16

Industrial Electronics

General Electric Co., Schenectady 5, N. Y. Bulletin GEA-4309, entitled "Fundamentals of Industrial Electronics," containing a reprint of a series of eight articles by G. M. Chute, application engineer. ... 17

Friction Sawing

Tannewitz Works, Grand Rapids 4, Mich. Catalogue illustrating and describing Tannewitz high-speed band saws used in the friction sawing of steel, non-ferrous metals, and other materials. ...18

Electric Equipment

Square D Co., 6060 Rivard St., Detroit 11, Mich. Catalogue 129, covering the company's line of electrical equipment, which includes safety switches, circuit-breakers, panel boards, etc. ...19

Baking, Drying and Preheating Equipment

Fostoria Pressed Steel Corporation, Fostoria, Ohio. Circular descriptive of infra-red Evenray systems for baking, drying, preheating, and dehydrating. ...20

Gages and Dial Indicators

B. C. Ames Co., Waltham, Mass. Catalogue 53, listing data on Ames gages and dial indicators for measuring, size control, and general testing. ... 21

Ampco Weld Rod

Ampco Metal, Inc., Milwaukee 4, Wis. Engineering Data Sheet No. 129, entitled "Scrap Prevention with Ampco-Trode"—a coated aluminum-bronze weld rod. ...22

Remote Controls

American Type Founders, Inc., Remote Control Division, 11 W. 42nd St., New York 18, N. Y. Bulletin on the Yardeny system of precision remote controls. ... 23

Seamless Flexible Hose

Eclipse Aviation Seamless Flexible Metal Hose Division, Bendix Aviation Corporation, Philadelphia, Pa. Circular on seamless metal flexible hose. ...24

Magnesium Castings

Superior Bearing Bronze Co., Inc., 140 Banker St., Brooklyn 22, N. Y. Circular containing information for the designer of magnesium castings. ... 25

Milling Machines

J. L. Lucas & Son, Inc., Bridgeport, Conn. Bulletin on No. 2 American milling machines. Also Bulletin 112S, on new and rebuilt machinery. ... 26

Stainless Steels

Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y. Folder listing the characteristics of Rezistal stainless steels. ... 27

Grinding Wheels

Norton Co., Worcester 6, Mass. Booklets entitled "Norton Grinding Wheel Markings" and "New Diamond Wheel Markings." ...28

Boring-Bars and Cutters

Standard Production Tool Co., Philadelphia 3, Pa. Catalogue on expansion, adjustable, and other boring-bars and cutters. ...29

Steel Tubing

Formed Steel Tube Institute, Cleveland, Ohio. Booklet for product designers on electric welded tubing and its applications. ...30

Air-Operated Equipment

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. Catalogue 1011, entitled, "A Little Air Power Will Do Many a Big Job." ...31

New, Rebuilt, and Used Machine Tools

Miles Machinery Co., Saginaw, Mich. Folder listing available new, rebuilt, and used machine tools. .. 32

To Obtain Copies of New Trade Literature

listed on pages 186-188 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name.. *Position or Title*..

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm..

Business Address..

City.. *State*..

[SEE OTHER SIDE]

Temperature Control

UNITED ELECTRIC CONTROLS CO., 69-71 A St., Boston 27, Mass. Bulletin 441T, descriptive of the Type K thermostat for the temperature control of electric devices. 33

Grinding Machines

NORTON CO., Worcester 6, Mass. Pamphlet entitled "Precision Plus Production with the Norton 4-Inch Type C Grinder." 34

Silver-Solder Flux

SUPERIOR FLUX CO., 1783 E. 21st St., Cleveland 3, Ohio. Bulletin descriptive of Superior No. 6 silver-solder flux and its use. 35

Lock-Nuts

FABRISTEEL, 642 Beaubien St., Detroit 26, Mich. Folder and engineering data sheet on FabriSteel Fast-On lock-nuts. 36

V-Belts

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis. V-belt drive catalogue, featuring Texrope drives. 37

Plastic Materials

HERCULES POWDER CO., Wilmington 99, Del. Technical booklet on cellulosic thermoplastics. 38

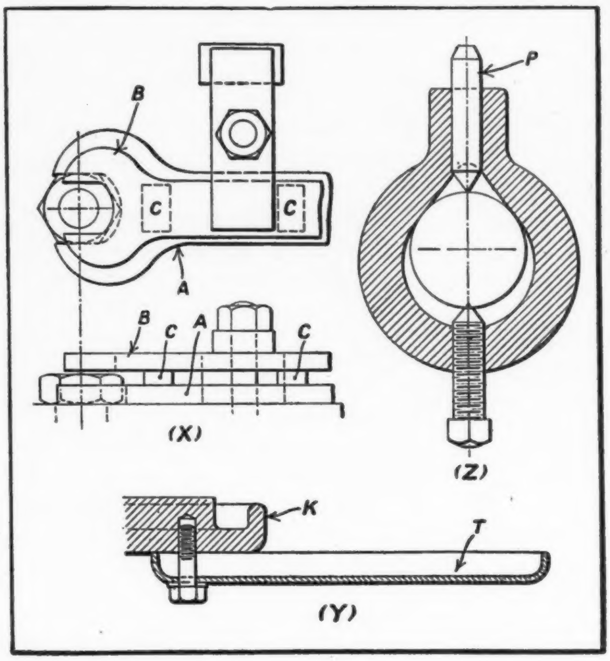
Electric Test Clamps

TRICO FUSE MFG. CO., Milwaukee, Wis. Bulletin on heavy-duty test clamps. 39

Simple Labor-Saving Devices for the Shop

Several simple labor-saving devices are shown in the accompanying illustration. An arrangement for quickly locating small nuts on the drill table is seen at *X*. The thin wrench *A* prevents rotation, while another wrench *B*, clamped in place as shown with spacing pieces *C*, holds the nut down.

At *Y* is shown a useful tool tray *T*, which can be attached to the table *K* of a drilling machine for occasional use. View *Z* shows a handy tool for producing diametrically opposite center-punch marks on round shafts. The center punch *P* is a slip fit in the V-grooved part.



Shop Labor-saving Devices

* * *

"Light metal permanent-mold castings," said L. F. Swoboda in a paper read before the Society of Automotive Engineers, "have greater dimensional accuracy than sand castings, but cannot be held to as close tolerances as can be obtained in precision die-casting. It is possible, however, to hold many dimensions to very close limits, but in such cases increased cost of product or a lower production rate may result. From the standpoint of economy, the designer should not specify tolerances closer than required by the purpose for which the casting is made."

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 190-210 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in February, 1945, MACHINERY.

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Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 182-183, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in February, 1945, MACHINERY.

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ELECTRICAL CONTROL
MAKES ALL GRINDING JOBS FAST JOBS
ON Nos. 20 AND 22 . . WITH REPEAT ACCURACY
KNOB TYPE MANUAL CONTROL
- - as well as SEMI-AUTOMATIC
by cross feed handwheel • • • •
1 Shortened Set-up Time
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. . . It will pay you to learn how
Nos. 20 and 22 Plain Grinding Machines
can help in your precision grinding.
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Nº 20
10" x 18"
Nº 22
10" x 36"
HEADSTOCK
TABLE
BROWN & SHARPE

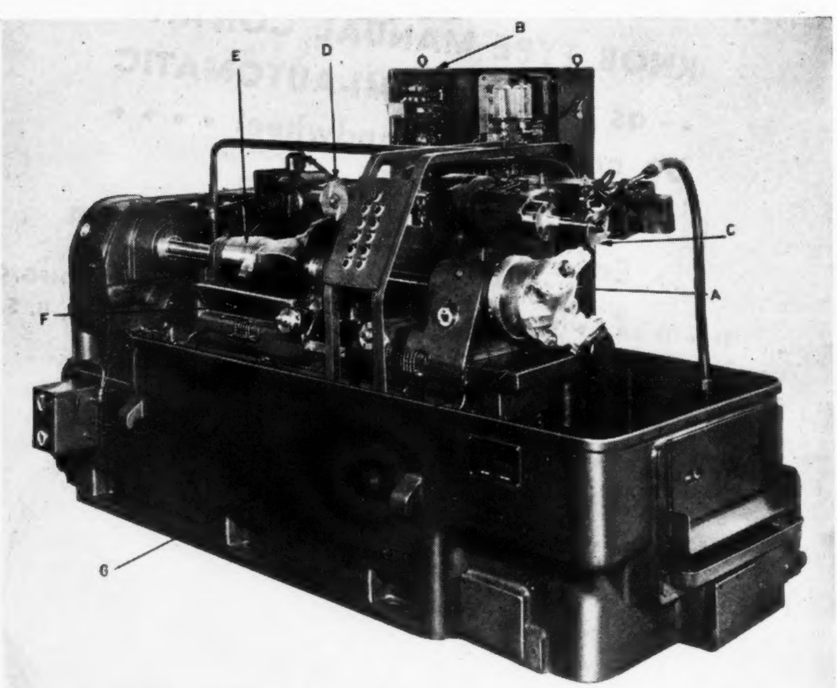
Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Automatic Electronically Controlled Machine for Milling Fins in Cylinder-Head Forging

The Sundstrand Machine Tool Co., 2530 Eleventh Street, Rockford, Ill., has designed and built the special machine shown in the accompanying illustration for milling the circular, partial, and dome fins on the forged aluminum airplane-engine cylinder head indicated at *A*. This machine will mill in two operations the same number of fins formerly requiring four separate operations on four machines. Actually, the milling of the circular and partial fins is accomplished in one operation. The milling of the dome fins requires a change in the cams, the tungsten-carbide tipped milling cutter *C*, and the work-holding fixture.

This special machine has incorporated in its design a combination of electronic control *B* with a hydraulic control. One of the outstanding features of this arrangement is the method of controlling the cutter load. The path followed by the cutter *C* is very irregular and constantly changing in shape and depth for each successive fin. With the automatic electronic feed control, the fragile cutter is kept loaded to full capacity. If the cut becomes light, the rate of feed increases, and if the cut becomes heavy, the rate of feed decreases. The rate of feed is thus varied automatically within a range of 6 to 60 inches per minute, the actual rate depending upon the depth of cut and power consumed.



Sundstrand Automatic Electronically Controlled Machine with Enclosing Panels Removed to Permit View of Cylinder Forging and Cutter Used in Milling Cooling Fins

The machine performs a completely automatic cycle after loading. The operator merely presses the control buttons, and the pivot arm that carries both the cutter *C* and cam roller *D* is moved by the rapid-traverse mechanism down to within 1/8 inch of the point at which the cut is started. The shaft that carries the master cam *E* and the work *A* then starts to rotate. Next the pivot arm feeds the cutter into the part until the cam roller comes in contact with the cam. The cam controls the path of the cutter until a complete fin has been cut. The pivot arm, which is actuated hydraulically, then withdraws the cutter at the rapid-traverse speed from the part, and the cam roller from the master cam.

The shaft carrying the cams and work is next rotated rapidly back to its starting position. The cam-carrier slide *F* and work-carrier slide *G* are then indexed laterally, so the next cam is in position under the cam roller and the work is in position for cutting the next fin. The cutting and indexing cycle described continues automatically until the last fin has been cut, after which the cam carrier slide and the work-holding slide index back to the starting position, and the machine automatically stops.

The irregular path of the cutter is controlled by the master cam *E* which is made up of a series of individual curves, one cam being provided for each fin to be cut. The head carrying cutter *C* and cam follower roller *D* are mounted on a single casting which pivots on widely spaced bearings. Thus, there is direct cam control of the cutter-head.

The master cams and work are mounted on one splined shaft, thus eliminating the possibility of error

To obtain additional information on equipment described on this page, see lower part of page 185.

in the relative rotation of the cams and the part. The work part is rotated through its feed and rapid-traverse cycle by an electrically controlled mechanical feed-box. Linear indexing of the cams from station to station is through a positive index-plate and lead-screw. The work is totally enclosed during the cutting cycle, the enclosing shield having a window through which the work and cutter can be observed. As the cycle is completely automatic, it is possible for the operator to run one or more machines if desired. The machine can be adapted to either individual or a central coolant system. By combining several operations in one machine, considerable floor space has been saved over the old method of machining. 51

Baldwin Hydraulic Press for Molding Plastics

A vertical hydraulic press for molding plastic parts, which utilizes high-frequency induction heating of the plastic material to effect great savings in production time, has recently been brought out by the Baldwin Locomotive Works, Philadelphia 42, Pa., the high-frequency elements having been developed by the Westinghouse Electric & Mfg. Co. In this press, the method of squeezing the preheated plastic into the mold makes high-speed thermosetting molding practical. The production from a comparatively small press with a small number of cavities can be made to equal that of a large compression press with a large number of cavities. Since a smaller press is required, the initial investment is reduced. Owing to the reduction in pressure on the material molded, the mold life is considerably longer.

The press just built is a 75-ton molding press, which can be used for both compression and transfer molding. It has a hydraulic plunger on top, which is used for pressing the preheated material into the mold. In straight compression molding, this cylinder is not operated. The press is equipped with a self-contained oil pump, located on the side. This equipment will be available in capacities of from 50 to 300 tons, and will be arranged to operate either directly from an accumulation system or by means of separate self-contained motor-driven pump units. 52

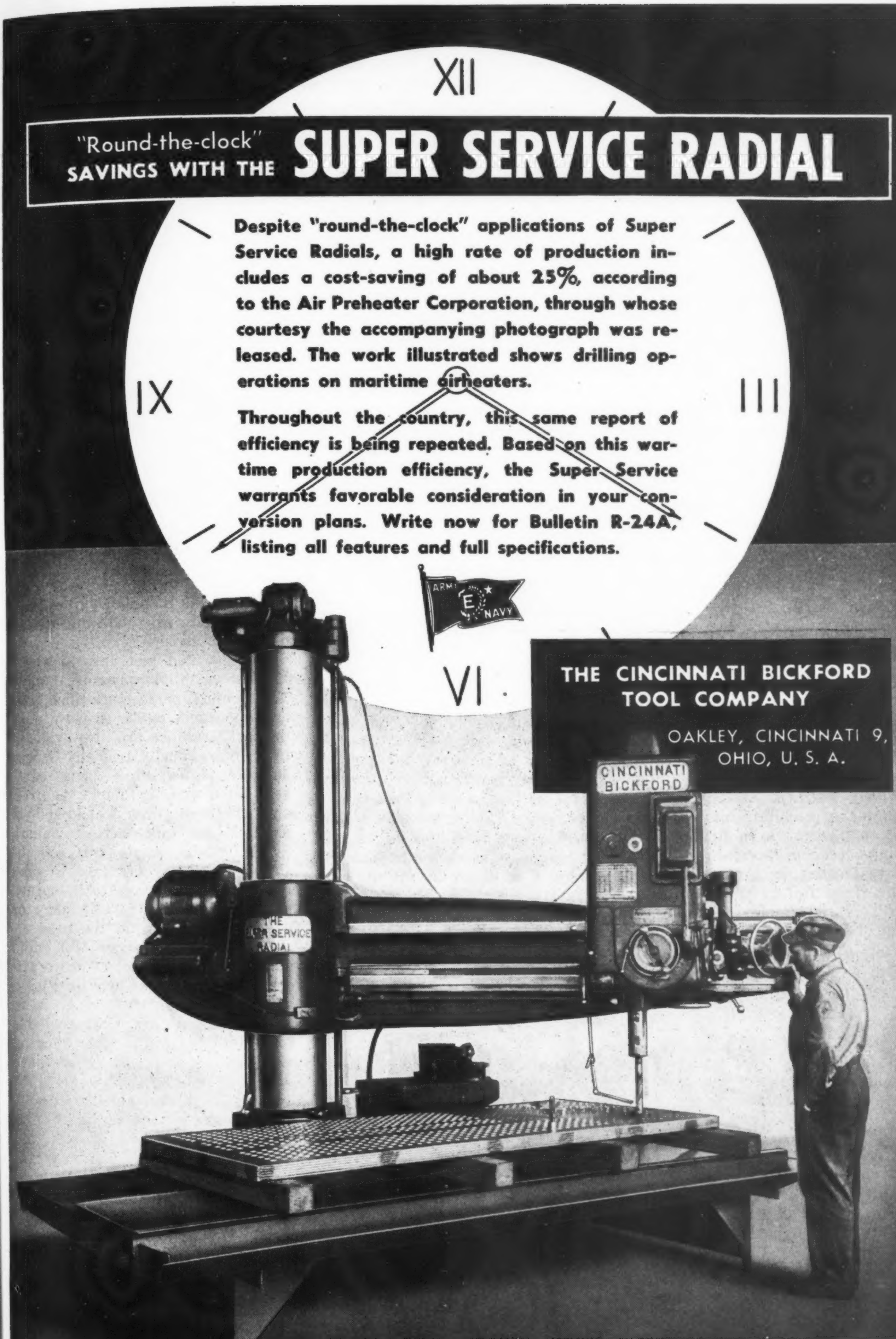
Porter-Cable Precision Wet-Belt Surfacer with Automatic Table Feed

An abrasive belt surfacer which can be used for either wet or dry grinding has been brought out by the Porter-Cable Machine Co., Syracuse 8, N. Y. This BG-8 grinder is equipped with a table

Baldwin Southwark Molding Press for Plastics, with High-frequency Induction Heating Unit

Porter-Cable Precision Wet-belt Surfacer Equipped with Automatic Table Feed

To obtain additional information on equipment described on this page, see lower part of page 188.


XII
"Round-the-clock"
SAVINGS WITH THE
SUPER SERVICE RADIAL
Despite "round-the-clock" applications of Super Service Radials, a high rate of production includes a cost-saving of about 25%, according to the Air Preheater Corporation, through whose courtesy the accompanying photograph was released. The work illustrated shows drilling operations on maritime airheaters.
Throughout the country, this same report of efficiency is being repeated. Based on this wartime production efficiency, the Super Service warrants favorable consideration in your conversion plans. Write now for Bulletin R-24A, listing all features and full specifications.
IX
III
VI
ARMY E NAVY
THE CINCINNATI BICKFORD TOOL COMPANY
OAKLEY, CINCINNATI 9, OHIO, U. S. A.
CINCINNATI BICKFORD
THE SUPER SERVICE RADIAL

having an automatic hydraulically controlled feed. It is adapted for tool-room, jobbing machine shop, and repair work, as well as for production work on duplicate parts. The machine and the jigs used with it are designed to permit the less experienced men and women to handle larger volumes of work of the kind requiring a superior finish and a high degree of accuracy.

The working surface on the standard plain table is 17 1/2 by 11 1/4 inches. The space available on the 8- by 9-inch plate is 7 3/4 by 9 inches; on the 12-inch plate, 11 3/4 by 9 inches; and on the 16-inch plate, 15 3/4 by 9 inches. Using the automatic feed table, the available space on the 8-inch plate is 7 1/2 by 9 inches; on the 12-inch plate, 11 1/2 by 9 inches; and on the 16-inch plate, 15 1/2 by 9 inches.

The abrasive belt is 9 inches wide by 107 inches in circumference. Plastic-bonded abrasive belts are available in grits ranging from No. 24 to No. 600. Coarse-grit belts (No. 24 to No. 60) are used for removing stock, while medium-grit belts (No. 80 to No. 120) are used for finishing. The finer grits are employed for polishing operations. Any grit used by the wet grinding method produces a finer finish than when used dry. For example, the finish obtained by wet grinding with a No. 120 grit belt is comparable to that obtained with a No. 200 grit used dry.

The standard abrasive belt speed is 3550 surface feet per minute. Seven optional speeds, available at no extra charge, range from 2550 to 5900 surface feet per minute. These speeds are based on a motor speed of 1725 R.P.M. A 5-H.P., 60-cycle, three-phase motor is recommended for driving the unit. The machine is 76 1/2 inches high, 44 inches wide, and 62 1/2 inches deep. The weight is 1700 pounds without the automatic feed table, which weighs 200 pounds. 53

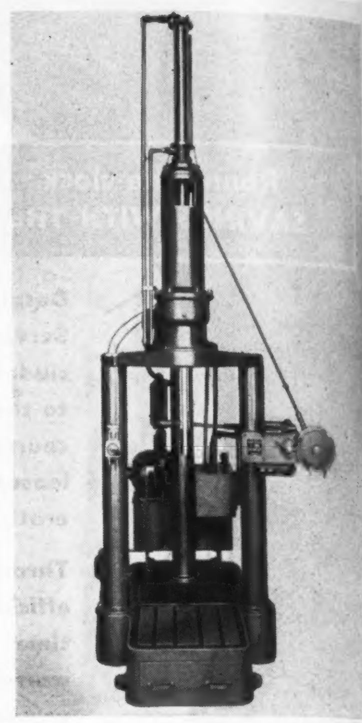


Fig. 2. Cylinder Honing Machine

Fulmer Piston-Ring Lapper and Cylinder Honing Machine

The C. Allen Fulmer Co., 1217 First National Bank Bldg., Cincinnati, Ohio, has just announced that the Fulmer piston-ring lapper, shown in Fig. 1, is now available for civilian use. This machine is designed to simplify aircraft-engine overhauling, and is being widely used in the field and in engine overhauling shops to eliminate guesswork in fitting piston-rings, reduce "break-in" time and save tearing down engines because the rings fail to provide a proper seal. It is simple to operate, and can be easily adjusted to handle rings of all diameters.

A full set of rings can be lapped in their cylinder barrels in sizes up to a maximum bore diameter of 6 3/8 inches on this machine. Machines can be supplied on special order to lap larger sizes. They are designed to give the lapping spindle a half revolution on a full upward stroke, with no rotation on the return stroke. At each reciprocating cycle, the spindle "hunts," or is indexed in such a manner that there is no possibility of the abrasive traveling over the same path on the next lapping stroke. The spindle operates in a bath of oil and carries a wiper seal that protects it from dirt and grit. Stops can be set to give working strokes of 2 to 12 inches.

Air-operated machines are built for use with air pressures up to 100 pounds per square inch, and are mounted on a sturdy work bench. Machines are also available in a hydraulically operated model. Adapter plates can be supplied to hold any size cylinder required, and the cylinders are locked in position by quick-acting clamps. Steel lapping heads can also be supplied for any engine that does not require the rings to be opened up when putting them in place or when taking them off the head.

The machine designed for rapid honing or lapping of aircraft-engine cylinders shown in Fig. 2 is another product of the C. Allen Fulmer Co. recently made available for civilian use. This honing machine is designed to produce straight, round, smooth bores to work tolerances as small as 0.0002 inch. It has a wide range of spindle and reciprocating speeds, and can remove material at an extremely fast rate with a high degree of accuracy. A fine surface finish is also obtained. The machine is especially suited for finishing aircraft-engine cylinders, connecting-rods, all types of internal combustion cylinders, supercharger parts, landing-gear struts, recoil cylin-

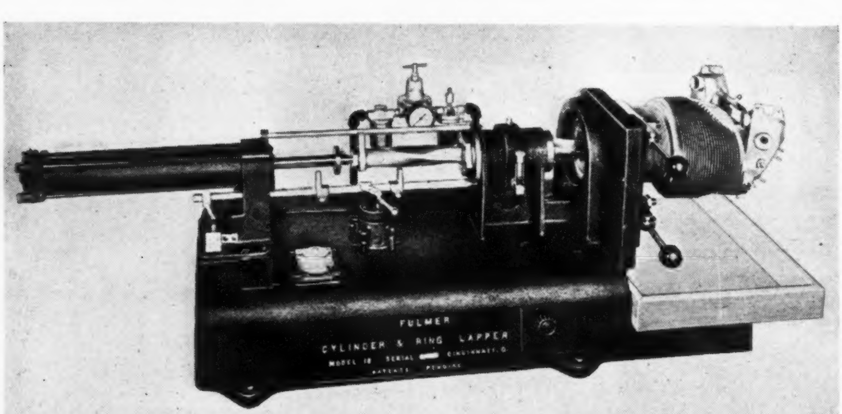


Fig. 1. Fulmer Air-operated Piston-ring Lapping Machine

To obtain additional information on equipment described on this page, see lower part of page 188.

ders, and similar work requiring extreme accuracy and a fine surface finish.

The Fulmer honing machine can be supplied in various working stroke lengths up to 72 inches, and with cylinder honing capacities up to 20 inches in diameter. All the controls have been brought down to floor level by the Fulmer patented control system, and are located at the front of the machine within easy reach of the operator. Stroke setting, hone withdrawal "short stroke," and changes in spindle or reciprocating speeds can be handled instantly from operator's station.

An ample supply of coolant is carried in the base of the machine, being passed through multiple settling chambers before it is returned to the work.

The reciprocating spindle can be stopped hydraulically at any point within the stroke capacity of the machine without shock or impact to the machine or work. The spindle is locked at the stopping point, and can be held there before upward movement takes place for any predetermined number of seconds by accurate electric timing. 54

Electrolimit Height Gage

Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn., has announced the addition of a reversing feature to the Pratt & Whitney Electrolimit height gage. The original head of this gage measures in one direction only, whereas the new head carries a small lever which permits setting the gage for measuring either up or down. This is an important advantage in making certain types of tool-room set-ups. The gage can be furnished complete with indicator and either of two stands, or the head alone can be purchased separately. This permits owners of the previous model to make use of the new head without replacing the stand or indicator.

The new reversing height gage operates on the same basic principle as all P & W Electrolimit gages—namely, the translation of a movement into electrical magnification which permits very sensitive measuring of precision work. The mechanical parts of this gage are made by Pratt & Whitney, and all coils and electrical parts by the General Electric Co. 55

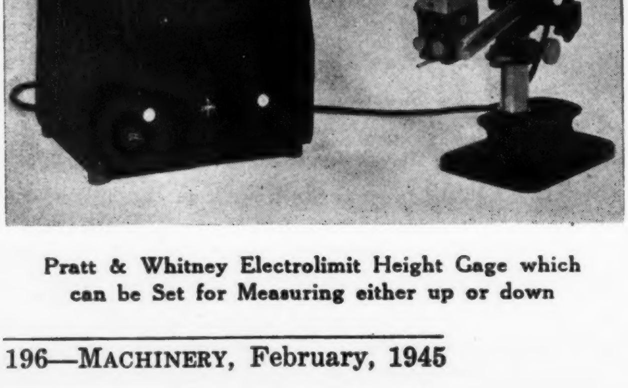
Sheffield Electronic Piston-Ring Inspector

The Sheffield Corporation, Dayton 1, Ohio, has brought out an electronic piston-ring inspection instrument, designed to eliminate the human element in gaging and enable piston-rings of a specific size to be automatically checked with a very high degree of accuracy for trueness of periphery and width of gap. The ring to be checked is inserted inside a master ring of correct dimensional size which is placed on the instrument table and rotated by a power-driven roller. The gaging functions are performed by scanning beams of light directed on photo-electric cells which energize electronic circuits to illuminate three signal lights.

As the ring revolves, one beam of light is projected on the periphery of the piston-ring. A clearance space between the piston-ring and the master inspection ring resulting from any out-of-round condition of the piston-ring permits part of the light beam to fall on the photo-electric cell. This cell is set to actuate a red rejection signal lamp should an excessive amount of light indicate that the piston-ring is out of round beyond the acceptable limit.

Should the periphery be within tolerance limits, a green signal will flash on at the end of one complete revolution, provided the width of gap is also within the predetermined tolerance, and a yellow signal will show if the gap is under size. The beam of light is interrupted by a mechanical shutter arrangement at the time the gap is passing this beam. Another beam of light scanning the width of gap and acting on a photo-electric cell causes the yellow signal light to flash should the gap be under size. A third beam of light energizes another photo-electric cell to illuminate the red rejection signal should the width of gap be over size.

Master piston-rings of known dimensional accuracy are used in adjusting the instrument to the desired tolerances. The instrument can be adapted to various nominal sizes, gaps of varying width, and also for variations on the allowable



Pratt & Whitney Electrolimit Height Gage which can be Set for Measuring either up or down

Sheffield Electronic Instrument Designed for the Automatic Inspection of Piston-rings

To obtain additional information on equipment described on this page, see lower part of page 188.

out of roundness of the periphery. Trueness of the periphery can be determined within a tolerance of 0.0001 inch.

With this instrument, the inspection cycle per piece is less than five seconds, the production rate being determined by the speed with which the rings are presented to the gage. In all cases, inspection is much faster than by present hand-checking methods. More important is the fact that the rings are checked accurately and uniformly, so that the possibility of assembly troubles is greatly reduced and better performance insured. 56

Federal Electronic Inspection Gage

The Federal Products Corporation, 1144 Eddy St., Providence 1, R. I., has added to its line of dial indicator gages a new electronic type gage known as the Federal Model 130 Foote-Pierson. This gage has been especially developed to permit faster and more positive gaging. Variations in position of the mechanical contact point are magnified by the electronic circuit.

This electronic type gage does not depend on "make and break" electric circuits, a Wheatstone bridge, or a magnetic field for its operation. Although the gage shown in the illustration is used as a comparator, the electronic principle on which it operates will be applied to hole and snap type gages, as well as special gaging equipment.

The Model 130 gage shown in the illustration is provided with both indicator dial and limit lights. The indicator dial at the left can be used when it is desired to determine how much a dimension varies from that specified, and for selecting work-pieces according to their dimensional variations. The indicator dial is also used in setting the gage. The limit lights to the right provide an extremely rapid means of inspection. The flashing of any one of the three lights indicates instantly the status of the dimension being gaged. One quick pass of the work under the contact point, as indicated by the enlarged diagram below the indicator dial in the illustration, is all that is needed to operate the gage.

The gage is set to a master by means of simple radio type knobs while observing the movement of the pointer on the indicator dial. Approximate location of a sensitive contact point is obtained manually by means of the lead-screw provided for lowering or raising the gaging head.

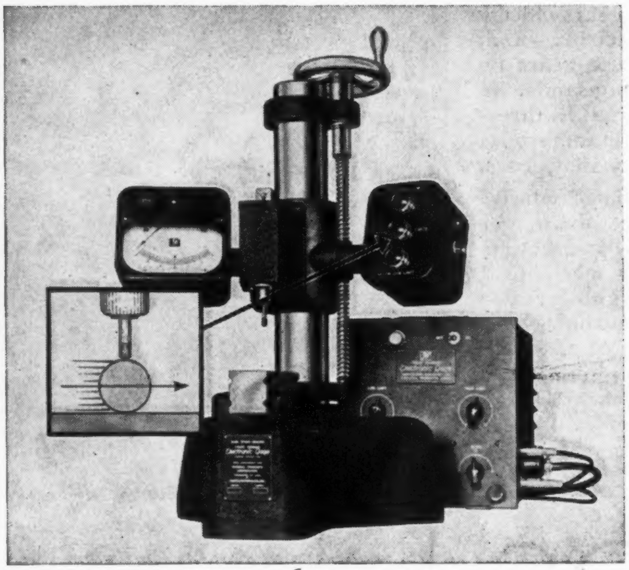
The indicator dial is provided with two scales. The lower scale is graduated 3-0-3, and the upper scale 1-0-1. The smallest division of each scale is either 0.0001 or 0.00001 inch, depending upon the magnification selected. Any one of four magnifications can be selected, as desired, by means of a four-position selector switch.

The pressure with which the contact point bears on the point being gaged can be adjusted from 1 1/2 to 16 ounces to suit requirements. This adjustment provides for gaging soft materials without marring or distorting them. 57

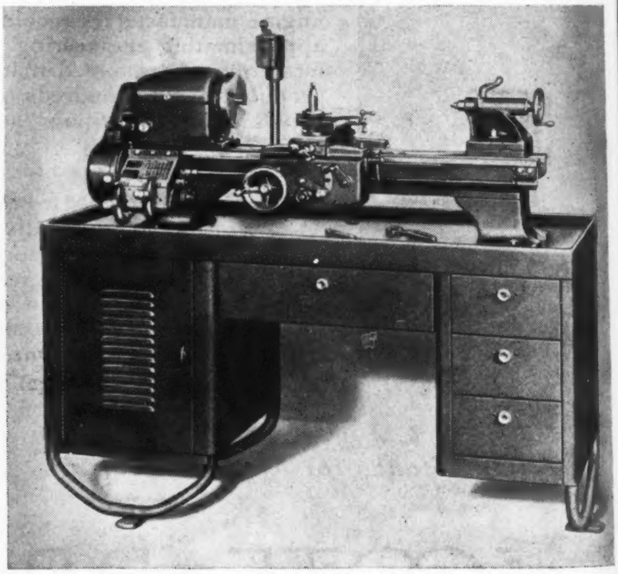
Logan Quick-Change Gear Cabinet Lathe

All the features of the standard Logan quick-change gear lathe have been retained in the No. 825 cabinet type lathe recently brought out by the Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, Ill. This new lathe is adapted for tool-room, maintenance, training, or production work. The entire unit is ruggedly built to withstand continuous use. The carriage has a friction-feed apron which travels over a bed that is ground to an accuracy of 0.0005 inch. Total run-out of the headstock spindle 12 inches from the bearings is less than 0.001 inch. The lead-screw accuracy is held to 0.002 inch in 12 inches.

The lathe spindle turns on a double row of preloaded precision ball bearings. Friction is minimized by self-lubricating bronze bearings at forty other vital points. The moving parts and gears are completely enclosed, the power



Electronic Inspection Gage Brought out by the Federal Products Corporation



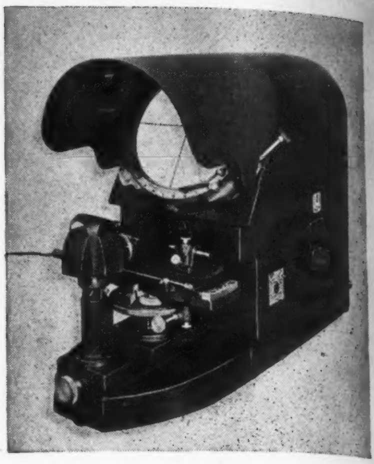
Quick-change Gear Cabinet Type Lathe Built by Logan Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 188.

plant and lower driving members being located in the left compartment of the four-drawer gray steel cabinet.

A multiple V-belt drive transmits power from a cone pulley to the spindle. Adjustments of both flat- and V-belt tensions are easily accessible to the operator. The unique three-point base assures a firm, steady installation on any type of floor. 58

Jones & Lamson Optical Comparator and Measuring Machine



Optical Comparator and Measuring Machine Made by Jones & Lamson Machine Co.

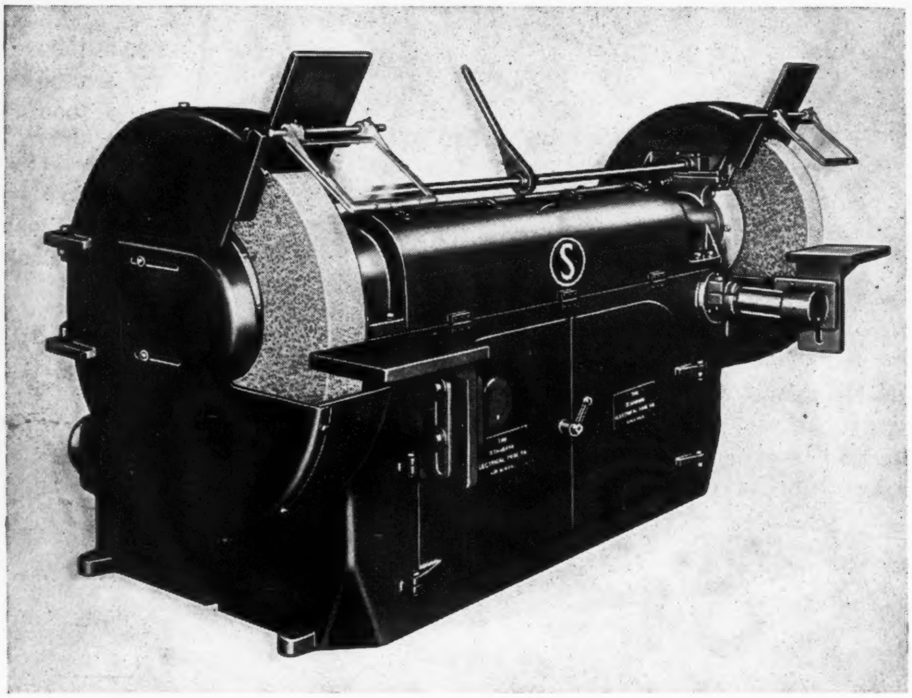
A 14-inch universal, bench model, optical comparator and measuring machine with a table 16 inches long that permits making measurements of lead and spacing up to 2 inches has been brought out by the Jones & Lamson Machine Co., Springfield, Vt. A handwheel with 0.0001 inch graduations, operating on a hardened and ground thread spindle, is used for making vertical measurements up to 1 3/4 inches. A ball thrust bearing with hardened steel plates is incorporated in the handwheel assembly to eliminate friction and assure easy and more sensitive operation.

On one end of the table is a vernier segment with provision for compounding or setting the table 15 degrees either side of the central position, and for projecting the profiles of hobs, worms, and threads in a plane normal to their helix angles. An attachment is provided for measuring angles in degrees and minutes. The maximum height of the lens above the table is 3 inches, and centers are available for staging objects up to 3 inches in diameter by 11 inches in length. Other fixtures that can be used with this machine are vise stage, right-angle stage, 1-inch V-block, and reflection attachment.

The lenses available for this machine are as follows: 82-millimeter lens system for projecting a 1.4-inch area at 10 magnifications; 46-millimeter lens system for projecting a 0.7-inch area at 20 magnifications; 48-millimeter objective with 10X ocular system for projecting a 7/32-inch area at 62 1/2 magnifications; 48-millimeter objective with 8X ocular system for projecting a 9/32-inch area at 50 magnifications; and 48-millimeter objective with 5X ocular system for projecting a 13/32-inch area at 31 1/4 magnifications. 59

Super-Duty Snagging Grinder

A 30-inch heavy-duty double-end snagging grinder, designated No. 75, has been brought out by the Standard Electrical Tool Co., 2500 River Road, Cincinnati 4, Ohio. This grinder has four spindle speeds, of 1200, 1375, 1675, and 1950 R.P.M., which can be used to maintain a surface grinding speed of about 9500 feet per minute on the two resinoid bonded wheels. The interlocking speed control is designed to prevent overspeeding of the wheels. Power is transmitted through a multiple V-belt drive. The shaft coupling is arranged to provide for convenient renewal of the V-belts.



Heavy-duty Snagging Grinder Brought out by Standard Electrical Tool Co.

The 30-H.P. ball-bearing motor is adjusted by an integral ratchet wrench to exert the correct tension on the V-belt drive. The steel boiler-plate guards can be conveniently adjusted to compensate for wheel wear by means of a rack and pinion mechanism provided with a built-in ratchet wrench.

Equipment includes adjustable spark breakers, eye shields, and heavy-duty workrests measuring 6 by 11 inches in size. The overall spindle length is 92 inches. The height of the spindle above the floor is 33 1/2

To obtain additional information on equipment described on this page, see lower part of page 188.

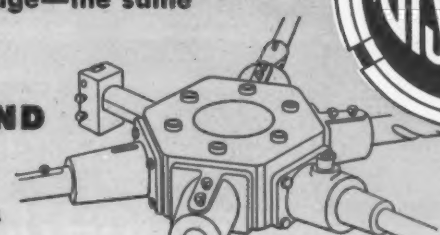
HOW MANY "MILES" for the Oil in your TURRET LATHE?

GISHOLT

√ CHANGE OIL IN RESERVOIRS REGULARLY

The oil in your turret lathe *wears out*—turns into sludge—the same as the oil in your car.

√ USE ONLY RECOMMENDED GRADES AND TYPES OF OIL—Cheap oil is never cheap. Incorrect grades of oil can gum up fine oil passages and result in serious and expensive trouble.



√ *Reproductions of this page on enameled paper are available for use in your turret lathe department. Write the Gisholt Machine Company, 1209 East Washington Avenue, Madison 3, Wisconsin. Ask for the series of "Wartime Care and Operation" posters. State quantity desired.*

inches. The base of the machine is 42 by 75 inches, and the machine weighs 5460 pounds. 60

Aluminum Mallets and Hammer Faces

Empire mallets and Basa replaceable-face hammers made by Greene, Tweed & Co., Palmetto Bldg., Bronx Blvd. at 238th St., New York 66, N. Y., are now available with aluminum heads and faces. Besides being spark-proof and easily refaced, the aluminum faces of these hammers are not brittle and do not chip.

In comparison with other materials frequently used in replaceable-faced hammers, aluminum is claimed to be tougher, more enduring, and better able to withstand impact blows. At the same time, it has the important quality of absorbing shocks, thereby minimizing operator fatigue.

When worn, heads or faces of aluminum can be readily trued up by turning or grinding. The split-jaw design of the Basa hammer head permits quick replacement of the soft faces. The new aluminum faces are interchangeable with the plastic, rawhide, copper, and babbitt faces with which Basa hammers have previously been supplied by the manufacturer. 61

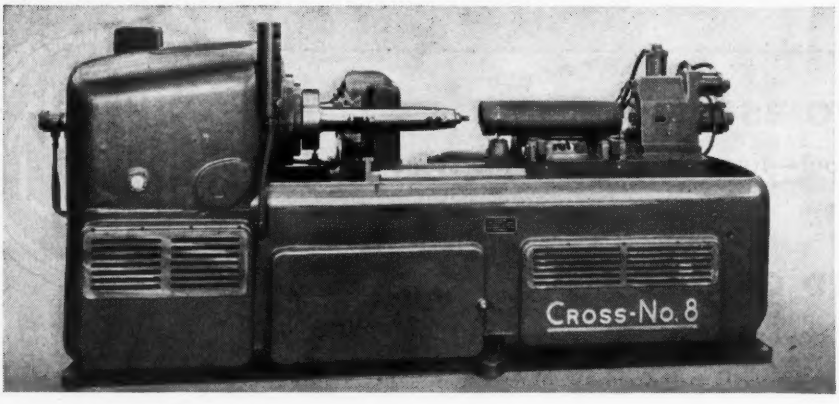
Demagnetizer for Small Tools Developed by Special Products Division, General Electric Co.

Cross Automatic Developed for Centering and Cutting off Shell Forgings

The Cross Co., Detroit 7, Mich., has developed a No. 8 automatic machine, shown in the accompanying illustration, for centering and cutting off shell forgings to the correct length in preparation for the required turning operations. It is built to handle shell forgings from 4 to 7 inches in diameter, the production on 155-millimeter shells being at the rate of 45 shells per hour with an operating efficiency of 80 per cent.

The machine is so designed that the shell forging simply rolls from the conveyor onto the loading carriage. This feature eliminates the necessity for lifting the work and, together with the safety provisions that enable the operator to stand clear of the danger zone when controlling the fully automatic work cycle, makes the machine well adapted for operation by women.

When the operating cycle push-button is pressed, the carriage moves toward the headstock and automatically loads the shell forging on the machine arbor, which then expands to grip the work in the cutting position. The loading rails in the carriage are automatically lowered to clear the work while it is being rotated and the cutting tools are being fed to depth. After the cutting operation is completed, the tools are automatically retracted, the work stopped, the chuck jaws released, the carriage loading rails elevated, and the shell forging removed by the lathe "pick-up" while the carriage is returned by power to the loading position. Unloading of the shell is accomplished by rolling it out of either the back or the end of the machine, as required by the conveyor installation. 62



Automatic Machine Built by the Cross Co. for Centering and Cutting off Shell Forgings

General Electric Demagnetizers

A new line of demagnetizers, designed to completely demagnetize magnetically soft materials, such as common irons and steels, and to partly demagnetize permanent magnets, has been announced by the Special Products Division of the General Electric Co., Schenectady 5, N. Y. These demagnetizers have been developed especially for demagnetizing tools, drills, and punches, in order to prevent excessive heat and wear caused by the adherence of magnetic chips. They are also desirable for demagnetizing various machined parts, thus releasing fine adhering particles which often affect the appearance of the finished part, causing severe wear and impairing accuracy. This equipment can also be used to adjust and stabilize the magnetic flux in permanent-flux assemblies for such applications as electrical instruments and control devices.

The demagnetizer consists of a cylindrical air-core coil, mounted in a stand at an angle of 45 degrees. It is available in a 4-inch size, rated at 115 volts 60-cycle alternating current, and in 8- and 12-inch sizes, rated at 220 to 440 volts. Long flexible leads are furnished with the 4-inch size for connection to the power line, while a small connection box behind the coil of the larger sizes accommodates standard electric conduits.

In operation, the rated voltage is applied and the material to be demagnetized is either passed di-

To obtain additional information on equipment described on this page, see lower part of page 188.

THE OUNCE THAT GREW

AN OUNCE is just an ounce, you say. But see what happens when it "runs wild" in a piece of high-speed machinery—a flywheel, for example.

As the wheel gathers speed, a single inch-ounce* of unbalance grows and Grows and GROWS till, at 5,000 R.P.M., it is multiplied over 800 times! No mere ounce, but *44.3 pounds* of additional load must be carried by the bearings, which seeks to tear the wheel from its moorings on each revolution.

Fortunately, this destructive vibration can be checked —quickly and at low cost—with GISHOLT DYNETRIC BALANCING MACHINES†. So simple has the process become that these unbalanced forces are now *located, measured* and *corrected* in a matter of seconds. And with a degree of accuracy that is not approached by any other means.

With vibration so easy to cure, why take chances? Gisholt engineers are ready to help you solve your particular vibration and balancing problems.

**An inch-ounce is the centrifugal effect produced by a one ounce weight one inch from axis of rotation.*
†A development of Westinghouse Research Laboratories.

GISHOLT MACHINE COMPANY
1209 East Washington Avenue • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements

GISHOLT

DYNETRIC BALANCING MACHINES are improving the performance of many vital war products such as armatures, crankshafts, aircraft propellers, supercharger impellers, etc. Write for complete information on Dynetric Balancing.

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

rectly through the coil or placed in its center and slowly withdrawn a distance of about 2 feet along its axis. At that point the magnetic field is negligible and the material is demagnetized. For continuous operation, non-metallic conveyor belts can be run through the coil, provided the parts being demagnetized are not enclosed in metal containers or make contact with each other in such a manner as to cause shielding. 63

DoAll Master Series Gage-Blocks

A No. 118 set of DoAll gage-blocks, designed for gaging departments that require a complete set of blocks covering any combination of sizes likely to be required in making precision measurements, has just been brought out by Continental Machines, Inc., 1312 S. Washington Ave., Minneapolis 4, Minn. It is claimed that this master series set of gage-blocks provides more duplicate combinations of the same size and makes possible a wider range of combinations than any previous set.

The set is divided into five classifications or size ranges. The first of these—the so-called "thin block" class—covers a range in size from 0.010 to 0.090 inch. It is made up of a series of thin blocks varying in size by steps of 0.010 inch; a second "thin block" series varies in size in steps of 0.001 inch and covers a range of from 0.021 to 0.029 inch; and a third "thin block" series varies in steps of 0.0001 inch and covers a range of from 0.0201 to 0.0209 inch.

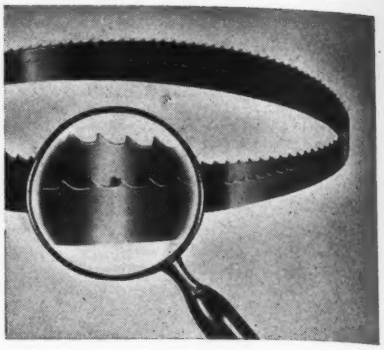
The second classification or size range includes the master series represented by blocks of the standard gage sizes. The first series varies in steps of 0.0001 inch, and ranges from 0.1001 to 0.1089 inch; the second series varies by steps of 0.001 inch and ranges from 0.101 to 0.149 inch; the third series varies in steps of 0.050 inch, and covers a range of 0.100 to 0.950 inch; while the fourth series varies in steps of 1 inch, and covers a range of 1.000 to 4.000 inches.

The third size range is based on the fraction system of measuring, and includes a series of three fractional-size gages—1/32, 3/64, and 1/16 inch—which, combined with six of the blocks, makes possible a combination of every fraction in steps of 1/64 inch from 1/32 inch to 2 47/64 inches, inclusive.

The fourth size range includes two gages—one 0.01005 inch and the other 0.10005 inch in size. With these two blocks used in combination with the standard gage-blocks, it is possible to make up sets of blocks for dimensions varying by 0.00005 inch or 50 micro-inches.

The fifth classification of gage-blocks in this master set consists of two 0.050-inch tungsten-carbide wear blocks.

Each gage-block is etched with its individual size, and meets or exceeds the requirements for gage-blocks established by the U. S. Bureau of Standards. Each block is stabilized by six cycles of annealing and freezing to minus 120 degrees F. It is claimed that the gage will not change more than a few millionths of an inch over a period of many years. This 118 piece set of blocks is available in three grades of accuracy: 0.000002 inch for laboratory; 0.000004 inch for general inspection; and 0.000008 inch for working sets. 64



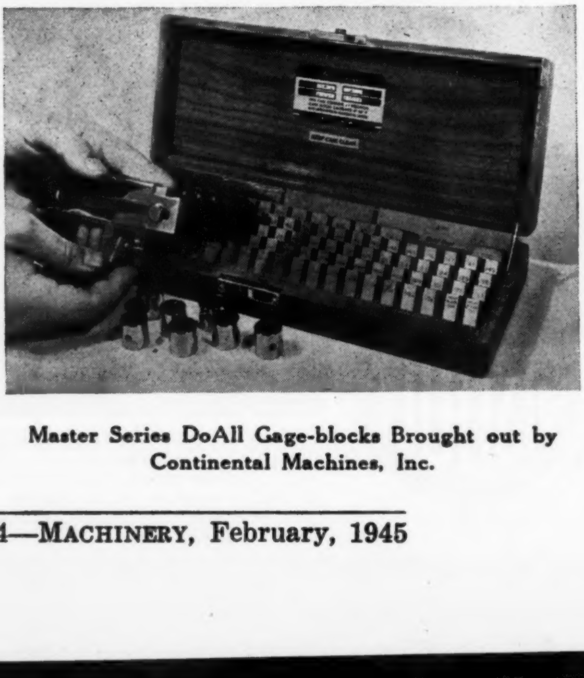
Barnes "Skip Tooth" Band Saw Designed for Fast Cutting of Non-ferrous Metals

Barnes "Skip Tooth" Band Saw

The W. O. Barnes Co., Inc., 1297 Terminal Ave., Detroit 14, Mich., has added to its line of metal-cutting saws a new "Skip Tooth" band saw especially designed for faster, easier cutting of magnesium, aluminum, soft brass, and other non-ferrous metals, and for the cutting of plastic, composition, fiber, wood, and similar materials. The "skip tooth" design, as shown in the illustration, provides greater chip clearance, the shape being such as to practically eliminate loading and clogging of the teeth. The saw blade is of hard-edge, flexible-back construction, and will fit any standard band saw machine 65

General-Purpose Diamond Tool Kit

A general-purpose diamond tool kit designated the "Abrasive G-P" or "jeep" kit has been placed on the market by the Abrasive Dress-



Master Series DoAll Gage-blocks Brought out by Continental Machines, Inc.

General-purpose Diamond Tool Kit Made by the Abrasive Dressing Tool Co.

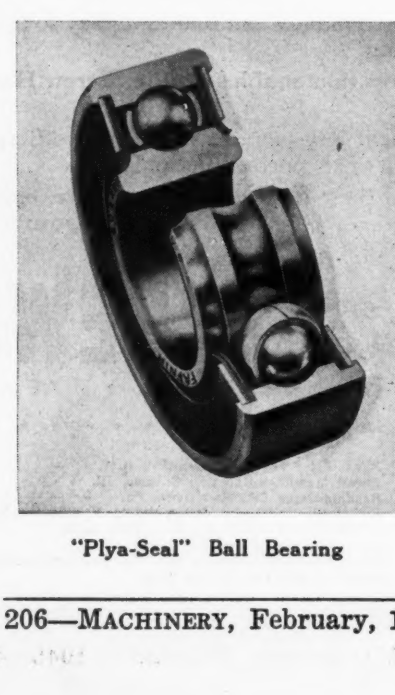
To obtain additional information on equipment described on this page, see lower part of page 188.

ing Tool Co., 1560 Broadway, Detroit 26, Mich. This kit contains an assortment of diamond tools designed to meet practically every requirement of medium-sized and small shops. The kit contains ten diamond tools; two tool-holders and two keys for locking the tools in the holders; diamond dressing tools; radius tools; cutting tools; phonopoints; and a diamond scriber. 66

Fafnir "Plya-Seal" Ball Bearings

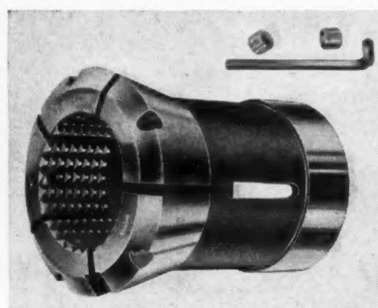
The Fafnir Bearing Co., New Britain, Conn., is placing on the market an entirely new type of sealed ball bearing, known as "Plya-Seal." The sealing element consists of a diaphragm type, contact seal comprising two members —a flat, flexible sealing washer of synthetic-rubber impregnated fabric and a split retaining ring of spring steel. Except in the extra small sizes, the space required for the two sealed parts is the same width as that of standard unsealed bearings.

The sealing washer, firmly held in the outer ring, does not rotate with the inner ring, but is kept in contact with a ground groove to form an effective seal with a maximum of friction. This seal can be easily removed and replaced to allow for inspection, washing, and greasing of the bearing. Performance in service has proved that Plya-Seal bearings assure a maximum retention of lubricant and maximum exclusion of dirt and liquids. As the seal causes no distortion of the outer ring or race, it does not affect the concentric relationship of the inner and outer bearing rings.



"Plya-Seal" Ball Bearing

The illustration shows the Plya-Seal disk wedged into the outer ring, where it maintains almost perfect contact with the inner ring and thus forms a positive seal. This seal is non-capillary and impervious to grease, oil, gasoline, water, and a variety of solvents. The new type bearings resist heat to a degree far in excess of the recommended limits for use of a grease-lubricated bearing, and also are unaffected by sub-zero temperatures. It is claimed that the sealing washer does not deteriorate with age. 67

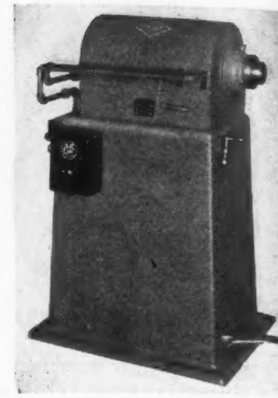


"Super Grip" Collet Made by Sheffer Collet Co.

Sheffer "Super Grip" Collets

A new collet with a "cup-point" lug in each serrated section which penetrates the stock slightly when in the locked position is being manufactured by the Sheffer Collet Co., Traverse City, Mich. In this collet, designated the "Super Grip," the lugs are usually set 0.010 to 0.015 inch above the regular serrations. They can be adjusted for more or less penetration or they can be turned down completely, leaving only the standard serration for effective clamping without removing the collet from the machine.

The "cup-point" lugs are replaceable at small cost. The collets are particularly adapted for handling hot-rolled steel and for work where heavy tool thrusts cause slippage in conventional serrated jaws. This type of collet was particularly designed for holding stock 2 inches in diameter and larger. 68



Schauer Variable-speed Polishing Lathe

Schauer Variable-Speed Polishing Lathe

Single foot-pedal control is a feature of an improved air-operated, heavy-duty, variable-speed polishing lathe brought out by the Schauer Machine Co., 2600 Reading Road, Cincinnati 2, Ohio. The air-operated work-spindle of this machine has a 1-inch hole through it which permits holding long rods and bar stock.

Collets up to 1 3/8 inches maximum capacity can be employed. Step chucks, expanding mandrels, or special work-holding fixtures can also be used. The motor operates continuously; depressing the foot-pedal closes the collet, releases the brake, and connects the motor to the work-spindle through a Twin-Disc clutch. The air line is provided with a control valve which permits a time lag before the collet releases the work.

Variations in spindle speed are obtained through the use of a Reeves drive with a convenient control handle. Spindle speeds from 100 to 4800 R.P.M. can be easily selected. This lathe is designed primarily for performing such secondary finishing operations as polishing, de-burring, filing, or lapping of metal and plastic parts. 69

Quickwork Rotary Shear Attachment

A cutting attachment to be used in connection with Quickwork rotary shears has been brought out by the Quickwork Division of the Whiting Corporation, 15673 Lathrop Ave., Harvey, Ill. This at-

To obtain additional information on equipment described on this page, see lower part of page 188.

tachment is used to cut the arc on cross-cut saws which vary in length from 2 1/2 to 7 feet. Prior to the application of the new attachment, this work was done by making a series of short straight cuts, which left high spots on the metal. The cut is now made by a continuous movement of the attachment, which materially increases production. 70

Indexing Fixture for Jominy Hardenability Bars

The Precision Scientific Co., 1750 N. Springfield Ave., Chicago 47, Ill., is manufacturing a new indexing fixture for Jominy hardenability bars, which has been developed in cooperation with J. T. Ferguson of Notre Dame University. This new fixture can be readily mounted on either the Clark or the Wilson hardness tester.

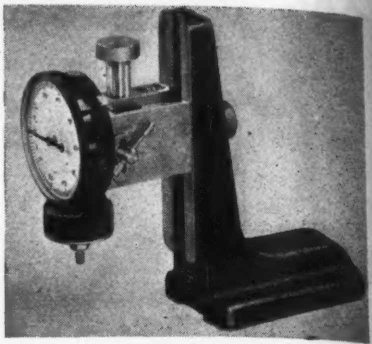
It consists mainly of a heavy base casting, an indexing screw, and a quick-return mechanism. The plug that supports the fixture in the hardness tester is hardened and ground tool steel. It projects upward through the base casting, and forms the surface that supports the Jcminy bar against which the hardness testing diamond is pressed. The screw for moving the carriage back and forth is of stainless steel, and is turned by a brass chromium-plated handwheel. A bronze half-nut is fastened to a quick-release lever which provides means for engaging the screw.

When the test bar has reached the end of its travel, the half-nut is released and the entire carriage slides back rapidly to the new starting position. An adjustable stop automatically locates the bar in the correct starting position. A spring plunger serves to hold the test bar firmly in position on the hardened steel stud. 71

Pedestal Indicator Designed for Use in Magnetic Fields

A non-ferrous pedestal indicator which can be used freely in active magnetic fields has recently been added to the line of indicators made by the Bartelt Engineering Co., 1412 Partridge Ave., Beloit, Wis. With the exception of the dial indicator itself, this new product, known as Model DNF-10, is constructed of hard brass. This permits setting up and checking work held on a magnetic chuck, an operation that is impossible with an ordinary height gage or other measuring device because of the strong pull of the magnetic field.

The new non-ferrous indicator and its steel counterpart, Model DF-10, are designed for gaging from flat surfaces, such as machine tables, surface plates, and machine beds or upright ways. For approximate setting, the carriage block is clamped where desired on the upright. The dial indicator is then adjusted to the exact position on the face of the carriage block with a micrometer screw, where it is fixed by separate clamps. This permits greater accuracy in making vernier adjustments and the carriage block serves to increase the clearance from the face of the pedestal upright.

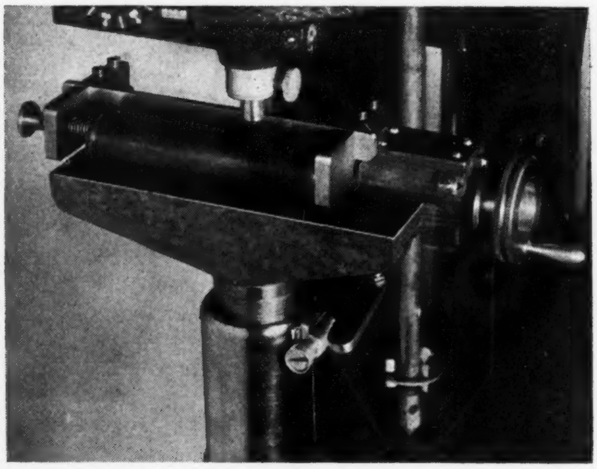


Bartelt Non-ferrous Pedestal Indicator for Use on Magnetic Chucks

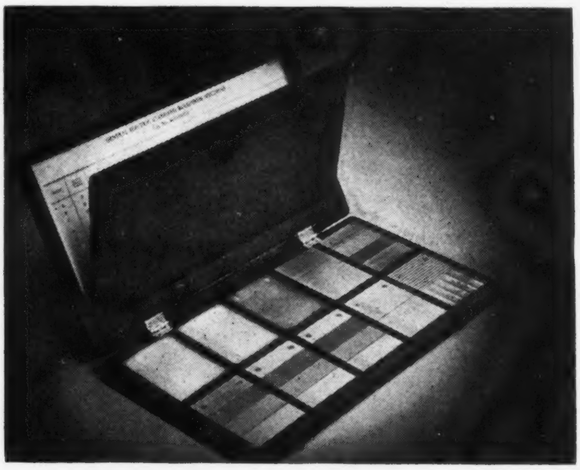
The dial is graduated for 0.0001-inch readings. The height of the instrument is 8 inches, and the range approximately 4 inches from the base surface upward. All surfaces of the gage except those that are ground or polished have a black crackle finish. 72

G-E Standard Surface-Roughness Specimens

A set of standard surface-roughness specimens, each representing one clearly identified degree of surface roughness ranging from the smoothness of a bearing surface to the roughness of a flame-cut piece, has been brought out by the Special Products Division of the General Electric Co., Schenectady 5, N. Y. The new specimens are designed to permit the engineer or draftsman to select and specify by symbol the special degree of surface roughness allowed for a particular machine part. They are of use in the shop, enabling the me-



Indexing Fixture for Jominy Bars, Made by the Precision Scientific Co.



Standard Surface-roughness Specimens Made by General Electric Co.

To obtain additional information on equipment described on this page, see lower part of page 188.

chanic to determine the exact surface roughness specified.

The set consists of ten metal specimens, each approximately 2 by 2 1/2 inches by 1/8 inch in size. Several of the specimens are divided into two, and in some cases four, surfaces all of which, while equally rough, are produced by different machine methods. In all, the ten specimens simulate twenty-five surfaces, each representing the roughest one acceptable for that particular symbol, regardless of the method of producing the finish or the material of which the part under inspection is made.

The specimens are furnished in a 12- by 6- by 1/4-inch cloth-lined wooden case, designed both for protection of the specimens and for convenience in handling. A chart on the inside of the cover lists the symbols of the various specimens for ready reference. Little experience is required in order to use the specimens efficiently, since comparison of the surface under inspection with that of the selected specimen is made visually and also by the sense of touch. 73

Drill Chucks for "Shankless" High-Speed Twist Drills

Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill., is manufacturing a new type drill chuck designed for holding the "shankless" high-speed drills produced for the metal-working industries by the Republic Drill & Tool Co., Chicago, Ill. Only seven sizes of drill chucks, ranging from No. 1 to No. 5 Morse taper, are required for driving the 135 different sizes of "shankless" drills now being made, which range from 1/4 inch to 2 inches in diameter. Seven additional sizes of chucks are provided, however, to convert the same range of drills to an "over-size shank series," and thus eliminate the necessity for using sleeves when larger taper shanks are required.

Scully-Jones Chuck for "Shankless" Twist Drills

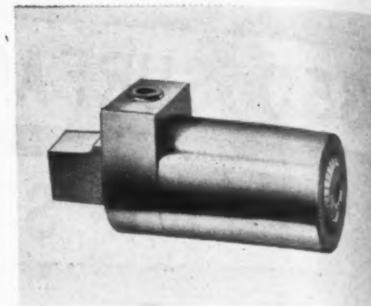
The new Scully-Jones chuck serves as a collet-action driver for driving shankless drills in any machine having a spindle holder or attachment with a Morse taper hole. This chuck is furnished with a Morse taper on the outside, and has a straight hole the same diameter and length as the neck of the shankless drill. At the bottom of the hole is a splined section in the form of an elongated slot with two opposite driving flats. This slot has an opening that permits the tang of the shankless drill to enter and engage the driving flats, thereby assuring a positive drive.

To insure accuracy and concentricity, all chucks for shankless drills are precision ground internally and externally. As part of the final inspection procedure, every chuck is assembled with a cylindrical gage of standard length, and is tested for concentricity at the outer end of the gage. 74

Nash-Zempel Boring-Bar Insert

The Nash-Zempel Tool Division of the J. M. Nash Co., 2354 N. 30th St., Milwaukee, Wis., has recently placed on the market a boring-bar insert with micrometer adjustment in which short pieces of scrap tool bits can be used as replacement cutters. Replacement of the cutter in this boring-bar insert simply requires the squaring up of the cutter stock to fit the square slot in the insert.

The insert can be installed on any bar available by a simple boring operation. The locating head of the boring-bar insert fits snugly into the recessed slot in the bar and always assumes the same position. The set-screw in the boring-bar locates the insert and draws the head firmly against the shoulder of the recessed slot in the bar, thus maintaining an accurate locating point.



Nash-Zempel Boring-bar Insert with Micrometer Adjustment

The micrometer dial of the insert has twenty-five graduations, each representing an adjustment of 0.001 inch. The insert can be removed from the bar by simply loosening one set-screw. This boring-bar insert is made in forty standard sizes, and can be provided with inserts for any standard or special bars and for bars that can be made by the user. 75

Ozalid "Rapid Black" and "Dryphoto" Papers

The Ozalid Division of General Aniline and Film Corporation, Johnson City, N. Y., has recently brought out "Rapid Black" and "Dryphoto" papers by means of which anything drawn, typed, printed, or photographed on translucent material can be reproduced quickly. With these new printing papers, photographic reproductions can be made by simply photographing the subject, making a positive film from the negative and then making the desired number of prints in an Ozalid machine. 76

Dry Tumbling Machine

A dry tumbling machine with an octagonal hard wood barrel, 14 inches in diameter by 24 inches long, has just been placed on the market by the Lewis Roe Mfg. Co., 1050 DeKalb Ave., Brooklyn 21, N. Y. The hard wood barrel of this machine has a partition in the center and is mounted on an iron stand. The machine has a 1/4-H.P. 110-volt alternating-current motor, with a speed reducer which drives the tumbling barrel at the rate of 40 R.P.M. 77

To obtain additional information on equipment described on this page, see lower part of page 188.

Cast Crankshafts in Diesel-Engine Construction

DURING the last few years, extensive tests and applications of cast Meehanite crankshafts for large Diesel engines have been made by the Cooper-Bessemer Corporation at its plants in Mount Vernon, Ohio, and Grove City, Pa. An analysis of methods and materials that might be used in producing heavy-duty crankshafts brought out the possibilities of effecting savings by modern casting procedure over conventional methods.

When steel ingots are used for forging crankshafts, often as much as two-thirds of the material is removed during the machining processes. For example, the crankshaft for an eight-cylinder marine Diesel engine that, completed, weighs 12,000 pounds, is made from a steel ingot weighing 36,000 pounds. Not less than 24,000 pounds is removed by the various machining processes.

The use of Meehanite castings for crankshafts by the Cooper-Bessemer organization is not a wartime development. Twelve cast crankshafts were produced and applied to engines as far back as in 1936. All these shafts performed satisfactorily, and there have been no failures.

Continuing this program, the company designed, in 1937, an engine that embodied a cast Meehanite shaft from its inception. The crankpins and journals of the shaft in this engine were 3 3/4 inches in diameter. The first engine was placed in operation in 1938, and 210 engines with cast crankshafts have been placed in service since without any failures.

The success of these earlier developments led to further applications on an even larger scale. A Diesel crankshaft 6 feet 6 inches in length with 8 1/2-inch diameter pins and journals was next completed and passed a three-months test successfully; but owing to a change in the production program because of Government orders, this shaft was not placed in production. Later, however, experimental work proceeded with the testing of an 8-foot 9-inch Diesel-engine cast shaft with 9 1/2-inch diameter pins and journals. This shaft, installed in an engine, ran 40,000,000 revolutions with high peak pressures. Although two pistons seized during the course of this test, the shaft was unimpaired.

More recently, the most spectacular test attempted by the Cooper-Bessemer organization was with a six-throw shaft casting 7 feet 8 inches long with 5 5/8-inch pins and journals, replacing a forged shaft. After 20,000,000 revolutions at 900 R.P.M. and 900 pounds peak pressure, no signs of failure were apparent in the shaft. During the next phase of the test on this shaft, it ran 20,000,000 additional revolutions at 900 R.P.M., but at 1000 pounds peak pressure. The bearings were then removed and the shaft was still found to be in perfect condition.

All the tests mentioned were conducted with crankshafts of "as cast" Meehanite, stress relieved but not heat-treated. In these tests, forged shafts made from 0.45 per cent carbon steel, with a minimum tensile strength of 80,000 pounds per square inch, were removed from assembled engines and replaced with cast Meehanite shafts. Pin and journal diameters and web thicknesses were not changed.

Simple Fixture Facilitates Assembly Riveting

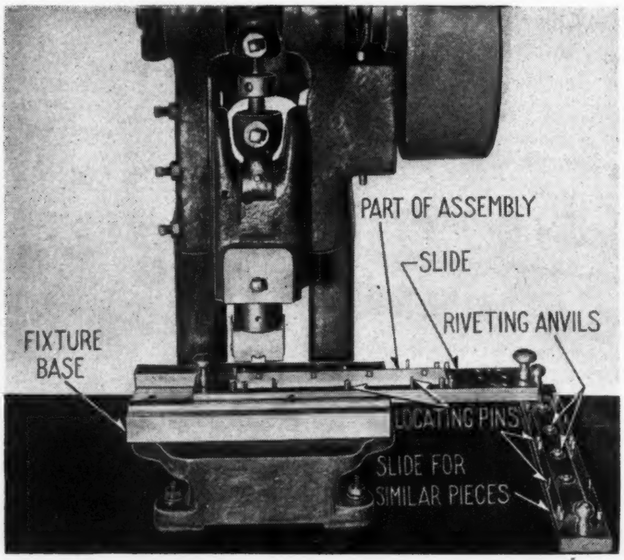
In the accompanying illustration is shown a simple riveting fixture of rather unique design, which is being used on a bench type punch press at the Sunbury plant of the Westinghouse Electric & Mfg. Co., to facilitate assembly work where many rivets are located at various intervals on a common center line.

The base of the fixture is fastened in a fixed position on the press table. Nested in the base, directly under the center of the punch, is a steel ball from a ball bearing, which is backed up by a spring to form a detent for locating purposes. The bottom side of the slide is counterbored under each riveting position, so that as the slide is moved, the steel ball, rising into a counterbore locates the assembly in position for riveting. A riveting anvil is mounted on the slide at each riveting position, as shown. Locating pins on the slide serve to position the pieces to be riveted.

The operator assembles the pieces in their correct positions and places the assembly in the fixture. As the assembly is moved from right to left, it is located in the first riveting position by the steel ball, which is forced to rise into the counterbore under the first riveting anvil. The press is then tripped and the punch forms the rivet head.

This operation is repeated until all the rivets in the entire assembly have been headed. The punch serves a twofold purpose—pressing the parts of the assembly together before riveting to insure a tight fit, and forming the rivet heads.

In the lower right-hand corner of the illustration is shown an assembly slide made for parts similar to the one shown on the press. A complete fixture need not be built for each job, as slides for various assemblies can be used on one base.



Bench Type Punch Press Equipped with Positioning Fixture for Holding Parts to be Riveted

Boron Carbide—Characteristics and Uses

Boron carbide in grain or powdered form, according to *Grits and Grinds*, published by the Norton Co., Worcester, Mass., is the hardest manufactured abrasive known. It finds applications in industry for work that before its discovery could be performed only with diamond dust. In molded form, boron carbide resists abrasion to a greater degree than any other substance except the diamond, and can be used where an exceedingly hard, smooth surface is desirable.

Boron carbide is made by the Norton Co. under the trade name "Norbide." Its development was the result of years of painstaking research. The Norton Laboratories were seeking to develop an abrasive material harder than silicon carbide, which for many years ranked next to the diamond for hardness.

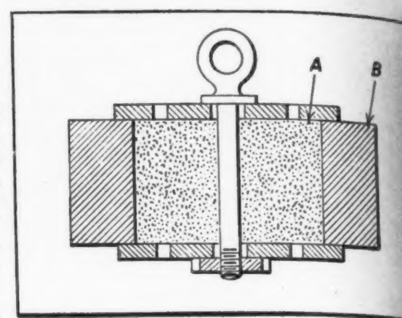
Boron carbide of the chemical formula B_6C had been made previously, but contained large amounts of free graphite. This product was without value in the abrasive field, since it consisted of a mixture of a small volume of material that has abrasive properties with a large volume of graphite that has lubricating properties. Ultimately, however, a method was discovered for producing in the electric furnace a new compound of boron and carbon that is of exceptionally high purity, containing not less than 99 per cent pure boron and carbon. Chemically, the formula is B_4C.

Besides the hardness of Norbide, the property of next importance probably is the fact that it is self-binding. Under tons of pressure and thousands of degrees of heat, powdered boron carbide can be molded without bond or cementing metal into a homogeneous, crystalline body of accurate dimensions. When polished, molded boron carbide has a hard, smooth surface.

Another valuable feature is its resistance to corrosion. It is unaffected by all solutions of acids and alkalies, both concentrated and dilute. Oxidizing acid mixtures have no effect on it, and oxidation affects the material but little up to 1800 degrees F.—a temperature at which the diamond burns.

In spite of its hardness, boron carbide is actually lighter than aluminum, its specific gravity being about 2.5. The compressive strength of molded boron carbide is 300,000 pounds per square inch.

Norbide is available in two forms. In powdered form, the material is an extremely hard abrasive, and is used for many grinding and lapping operations that previously could be performed only with diamond dust. In the molded form, Norbide is extremely resistant to abrasion, and is used where an extremely hard, smooth, wear-resisting material is required. Perhaps the most widespread application of molded Norbide today is as a lining for the nozzles used in pressure- or sand-blasting. These linings show many thousand times the wear resistance of any metals previously used for this purpose.



Method of Hardening Outside Surfaces of Steel Rollers

Hardening Outside Surfaces of Steel Rollers

Steel rollers like the one shown at *B* in the accompanying illustration were required to be hardened on their outside surfaces. When this hardening was performed in the usual manner, some of the rollers cracked on being immersed in the quenching water. To avoid a repetition of this trouble, the following method was adopted. Asbestos *A* was closely packed in the bore of the roller *B*, where it was held in place by two washers and a bolt, the latter being used for handling purposes. Two 5/8-inch diameter holes were drilled through each of the washers, as shown, for ventilating purposes.

To obtain the best results, the asbestos packing was water-soaked and packed as hard as possible. On cooling, the rolls hardened as described are found to be soft on the inside and hardened as required on the outer surfaces.

William McHugh, Seventy-eight-year-old Master Bulletmaker at the Winchester Repeating Arms Co., has been with That Organization for Sixty-one Years, during which Time He has Supervised the Production of Billions of Bullets of Some 800 Different Types. The Winchester Organization Includes 824 Members—20 Per Cent of the Peacetime Personnel—who have been with the Company More than Twenty-five Years

Equipment for Controlled-Atmosphere Furnace Brazing

CONTROLLED-atmosphere furnace brazing is a method of bringing metals together with various brazing alloys in an atmosphere that prevents oxidation of the parts being brazed and reduces slight oxides that may be present. According to A. K. Phillippi, manufacturing engineer of the Westinghouse Electric & Mfg. Co., Springfield, Ohio, this process has many advantages. When the design of the parts being manufactured is suitable for furnace brazing, the results are very satisfactory. The parts come out clean; they have been evenly heated and cooled and therefore there is a minimum of distortion; and when properly processed, the product is stronger and better than when made by other means.

This method of fabricating and assembling sheet-metal and screw-machine parts is used to an increasing extent in industry. Many methods of joining metal have been developed in recent years, but none of them appears to have the possibilities or economies of the method known as "controlled-atmosphere brazing." Numerous articles have been written pointing out the possibilities of this method of joining metals. Yet the method has not been applied in industry anywhere nearly as widely as might have been expected.

The furnaces used for brazing with this method generally consist of a charging chamber, a heating chamber, and a cooling chamber. They should be so built that the room atmosphere cannot enter and ruin the controlled atmosphere. The size of the equipment is governed by the amount of work (in pounds) required per hour, as well as by the size and weight of the parts.

The bell type furnace consists of a hearth and bell, which rests in a groove having a seal of some kind to prevent the leakage of controlled atmosphere. This type is used when heavy pieces are to be brazed.

The belt-conveyor type is used when small parts are to be brazed in large quantities. It consists of three chambers and an endless belt, on which the pieces are placed. The speed can be regulated to allow the proper time for the brazing operation. These furnaces are built for various belt widths from 6 to 24 inches, and with an average capacity of approximately 7 pounds per linear foot of belt. The brazing temperature is approximately 2050 degrees F.

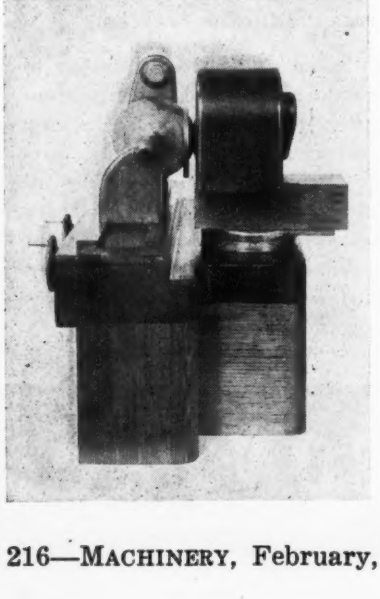
The roller-hearth type also has three chambers, but the work passes through the furnace on trays, propelled by means of rollers which are driven by a sprocket and chain drive at variable speeds. The bearings for the rollers are water-cooled at and near the heating chamber. This type of furnace is capable of handling much heavier pieces than the belt type, the only limiting factor being the carrying capacity of the rollers at the brazing temperature. These furnaces have a maximum output of from 500 to 2000 pounds per hour. The door openings are from 18 to 24 inches wide and from 10 to 13 inches high.

The pusher or batch type furnace also has the three conventional chambers, but the work is pushed through on trays and allowed to remain in the respective chambers the proper length of time for the purging, brazing, and cooling cycles. This type of furnace has a capacity of from 15 to 80 pounds per hour, and the door openings are from 8 to 13 inches wide by 6 to 12 inches high.

In addition to the furnaces, it is necessary to have equipment for producing the proper atmospheres for controlling and reducing oxides, as well as to prevent carburization and decarburization. The equipment for producing the proper atmospheres includes gas generators and combustors. Every company manufacturing this type of generator or combustor has its own trade name for the atmosphere that it produces.

* * *

The cathode and anode of an electronic tube correspond to the terminals of an ordinary single-pole switch, but the action is many thousand times faster than that of any mechanical switch.



Wooden Models are of Considerable Aid to the Machine Designer. The Illustration Shows a Quarter-size Wooden Model of a Proposed Grinding Machine. This Model was Made at the Lynn River Works of the General Electric Co.

Increasing Use of Latex-Coated Metals

The post-war use for synthetic Latex coated metals will greatly increase when civilian manufacturing is resumed. This method of insulating and coating metals of intricate shapes without the use of molds and dies was developed by the United States Rubber Co. some years ago, when it was adopted to eliminate the effects of abrasion and rust, as well as acid and alkali corrosion. The method also provides a cushioned and non-slip surface for hard metals, and has been used extensively in the war industries.

VERSATILE HOB AND MILLING CUTTER CHECKER
Exact Size Measurements of External and Internal Helical Involute Gears
Cone-Drive Gea
in new Shell Lathes
GEAR SHAPING AND SHAPER CUTTERS
FINE PITCH GEARS
By K. E. Bauerle, Gear Engineer, [redacted]
SHAVED-GEAR QUALITY
"Largest" Generated Gear
Locating Gear Troubles
Novel Pinion Mounting Simplifies Assembly
ZERO BACKLASH IN SPLINES NOW POSSIBLE
Universal Products adapts gear shaving process to production of splines for automotive use
Shaving and Lapping Gears
Standardized Equipment Adapted By [redacted] For Precision Gears
Largest GEAR FINISHER SHOWS FLEXIBILITY at [redacted]
MASS PRODUCTION OF SMALL FINE PITCH GEARS
AERO ENGINE GEARS NOW FINISHED BY SHAVING
[redacted] USES BATTERY OF MICHIGAN TOOL 860-B ROTARY GEAR SHAVERS
Correct Locating Methods Eliminate Misalignment
QUENCHING DIES CONTROL
LAPPING HINTS
NEW CUTTER RELIEVING MACHINE
CONTROLLING SHAVED AERO-GEARS QUALITY
Checks Spiral Gear Leads From Zero To Infinity
New Internal Gear Finishe
CONE-DRIVE ASSEMBLY SIMPLIFIED
News on Gear Production
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Detroit 12, Michigan
Originators of Gear Finishing
Are you on the GEAR PRODUCTION HIGHLIGHTS Mailing List?
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News of the Industry

California

UTILITY FAN CORPORATION, 4851 S. Alameda St., Los Angeles 11, Calif., announces that the name of the organization has been changed to UTILITY APPLIANCE CORPORATION. There is no change in the management.

Illinois and Indiana

FRANKLIN W. OLIN has retired as president of the Western Cartridge Co.'s group of industries now included in the merged corporation OLIN INDUSTRIES, INC., East Alton, Ill. Mr. Olin was eighty-five years old on January 9. He will be succeeded as president of the organization by his son, JOHN M. OLIN, who has been first vice-president. SPENCER T. OLIN, a younger son, who has held the office of western vice-president, becomes first vice-president.

EDW. S. CHRISTIANSEN CO. has been formed for the purpose of dealing in magnesium and aluminum scrap and finished materials. The main office will be at 160 N. La Salle St., Chicago 1, Ill. Shortly, Mr. Christiansen, who heads the firm, will announce the formation of a manufacturing company for processing magnesium in various forms for foundry, wrought, and other fabricated uses.

W. H. BREWER, general manager of the Aurora, Ill., factory of the Independent Pneumatic Tool Co., Chicago, Ill., has retired from active work due to failing health. Mr. Brewer was connected with the company for thirty-six years. He served as works manager from December, 1940, to April, 1944, when he became general manager.

U. S. GAUGE CO., Sellersville, Pa., announces the removal of its Chicago office to the Monadnock Block, 53 Jackson Blvd., Chicago 4, Ill. This office will be under the direction of WALTER H. MAGEE, district sales manager, who was previously Chief of Pressure Instruments with the War Production Board, Washington, D. C.

ROY S. KERCHER has been appointed chief electrical engineer of the Grayhill organization, La Grange, Ill., manufacturer of rotary and snap-action switches. Mr. Kercher is a graduate of the Armour Institute of Technology. He has previously been associated with Cutler-Hammer, Inc., and the Furnas Electric Co.

DEL C. WISEHEART, formerly with the Revere Copper & Brass Co., has been appointed personnel manager for the Oscar W. Hedstrom Corporation, 4836 W. Division St., Chicago, Ill., manufacturer of aluminum products, copper castings, electrical products, precision instruments, and wood and metal patterns.

ROCKFORD DRILLING MACHINE DIVISION of BORG-WARNER CORPORATION, Rockford, Ill., has changed its name to the ROCKFORD CLUTCH DIVISION of the BORG-WARNER CORPORATION. The Division will also operate a research laboratory in Rockford under the name of ROCKFORD CLUTCH ENGINEERING LABORATORY.

JUSTUS W. LEHR has been appointed district manager of the Chicago plant of the American Car and Foundry Company, 30 Church St., New York City. He has been connected with the company since 1940, and previously served as assistant district manager of the Berwick, Pa., plant.

AMOS BALL, vice-president in charge of sales and a director of the Standard Oil Co. of Indiana, has retired after completing forty-eight years of service with the company. ROY F. MCCONNELL, formerly general manager of sales, succeeds Mr. Ball as vice-president.

DR. MAX MULLER, formerly superintendent of refractories of Basic Magnesium, Inc., Las Vegas, Nev., has been placed in charge of the research and experimentation department of Titan Abrasives Co., Chicago, Ill.

C. A. WOODLEY, until recently factory manager of the Caterpillar Tractor Co., Peoria, Ill., has been made assistant general factory manager, and WILLIAM NAUMANN, formerly assistant to Mr. Woodley, has been promoted to the position of factory manager.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces that its Peoria, Ill., office has moved into larger quarters in the Electrical Bldg., 214 Second St. L. W. O'DAY, who has been manager of the Peoria office for four years, is in charge.

LUTHER & PEDERSEN, 565 W. Washington Blvd., Chicago 6, Ill., have been named exclusive sales representatives in the Chicago territory for the G. A. Gray Co., Cincinnati 7, Ohio.

CHARLES STECHER CO. will be known in the future as HOPKINS MACHINE CORPORATION, and will be located at 4243 W. Diversey Ave., Chicago 39, Ill.

ASSOCIATED ENGINEERS, INC., management engineering consultants, have recently purchased a two-story office building at 230 E. Berry St., Fort Wayne, Ind., as part of the company's expansion program.

Michigan

BOWSER, INC., Fort Wayne, Ind., has leased two plants of DEXTER MACHINE PRODUCTS, INC., at Chelsea and Stockbridge, Mich., in order to expand its war production program. The new property will be known as BOWSER, INC., DEXTER DIVISION. R. F. TRIMBACH, who has been acting as chief of the Manufacturing Methods Section of the Army Air Corps at Wright Field, Dayton, Ohio, has been lent to the Bowser organization by the Government in order to serve as general manager of the Dexter Division. The Dexter company was engaged in manufacturing high-precision shaved gears. The two Michigan plants of the Dexter Division will continue in operation with the same personnel.

SUPER TOOL CO., 21650 Hoover Road, Detroit 13, Mich., manufacturer of carbide-tipped tools, announces the acquisition of the "Cal-Cutter" line of milling cutters, formerly manufactured in Los Angeles, Calif. These tools will henceforth be produced in Detroit, but will continue to be marketed by the Cal-Cutter Co., located at the offices of the Super Tool Co.

WALTER W. BERTRAM has been elected vice-president in charge of sales of the Morse Chain Co., Division of the Borg-

Walter W. Bertram, Vice-president in Charge of Sales, Morse Chain Co.

MANUFACTURING

CONTROL

THE KEY TO UNIFORM CARBIDES

THE art of manufacturing uniform cemented carbides requires the same "exceeding care" exercised by the talented research men who established the fundamental principles and practices of this highly specialized branch of metallurgical science. That is why Kennametal is subjected to precise control throughout every stage of its manufacture, by means of scientific instruments in the hands of skilled technicians. The objective of the chemical and metallurgical checks of processing is three-fold:

First, *to produce cemented carbides that will exactly suit predetermined requirements of differing character.*

Second, *to assure that the desired characteristics of finished products are uniformly maintained.*

Third, *to form the basis for continued research looking to still further improvement in the properties and applicability of Kennametal.*

● The invention and development of Kennametal—a scientific achievement—has led to corresponding useful arts. Kennametal's ability to cut hard metals with sustained accuracy, at greatly increased speed, has made major contribution to the technique of high production machining and milling. Its unique wear-resistant properties have created opportunity which many manufacturers have seized upon to give their products greater serviceability.

The technological advancements that accompany the use of Kennametal serve to suggest the tremendous potential benefits to society that are always inherent in a system under which inventive genius is granted the rights, and given the means, to encourage full utilization of its talent.

Typical **KENNAMETAL** *Products*

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SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

Robert J. Howison, Newly Appointed Sales Manager, Morse Chain Co.

Warner Corporation, Detroit 8, Mich. Robert J. Howison has been appointed sales manager. Mr. Bertram was formerly sales manager, and Mr. Howison was in charge of automotive sales.

Detroit Mold Engineering Co. announces that the general offices of the company, formerly located at 4835 Woodward Ave., Detroit, have now been moved to the factory, 6686 E. McNichols Road, Detroit 12, Mich. A complete new plant building has recently been erected, adjoining the present manufacturing properties. This building adds 50 per cent to the available floor area.

W. S. Rockwell Co., 50 Church St., New York 7, N. Y., manufacturer of furnaces and ovens, has appointed Stanley D. Whiteside district engineer for the Michigan area, with offices at 1010 Stephenson Bldg., Detroit 2, Mich.

Kennametal Inc., of Latrobe, Pa., has announced the addition of two new tool engineers to its staff at the Detroit, Mich., office, Leonard K. Weeks, formerly service engineer for the Cincinnati Milling Machine Co., and John R. Gough, formerly tool supervisor for George D. Roper Corporation.

John D. Kershaw, Jr., has been appointed field engineer for the Hanson-Van Winkle-Munning Co., Matawan, N. J., with headquarters in the Detroit office at 2842 W. Grand Blvd., Detroit, Mich.

A. A. Tackus has been promoted to the position of assistant to the executive vice-president of the Aviation Corporation at the corporation's Detroit office, 5914 Federal St.

New England

Lieutenant Colonel Alden F. Erikson has just returned as district manager of sales for the Wyckoff Steel Co., in the company's Boston office. Colonel Erikson has been in military service for the last thirty months, serving in the South Pacific War area as an officer in the Coast Artillery Service and later in the Anti-Aircraft Division. His headquarters will be in the United Shoe Machinery Building, Boston, Mass.

Reid Brothers Co., Inc., announces that henceforth all sales of Reid surface grinders and parts will be handled directly from the company's plant and main office at Beverly, Mass. For the last four years such sales have been handled through a general sales agent. It is also announced that a new advertising department has been formed, with Paul S. Hubbard as manager.

Wendell A. Melton has been appointed district manager in charge of the Tulsa territory for the Foxboro Co., Foxboro, Mass., maker of industrial instruments for measurement and control. The Tulsa office is located in the McBirney Bldg., Tulsa 3, Okla.

Ready Tool Co., Bridgeport, Conn., manufacturer of tool-holders, lathe and grinder centers, and other shop equipment, has been sold to the United Tool & Die Co., Inc., Hartford, Conn. The Ready Tool Co. will continue to manufacture and sell its products at its present location. James J. Carney will be president, and Lawrence J. Delaney secretary and treasurer, positions which they now hold with the United Tool & Die Co. Thomas Fish, who for many years has been president and manager of the Ready Tool Co., will continue with the new organization for a limited time as vice-president in charge of sales, and Carl B. Christensen, who has been superintendent, will continue as vice-president and superintendent in charge of manufacture and production. Harold Fish will serve as consulting engineer.

New Jersey

Clarence E. Searle was elected president of the Worthington Pump & Machinery Corporation, Harrison, N. J., at a recent meeting of the board of directors. Mr. Searle succeeds Harry C. Beaver, who has been elected vice-chairman of the board of directors and chairman of the management committee. Mr. Beaver has been president of the corporation since 1931, and Mr. Searle has been vice-president in charge of sales since 1932. Hobart C. Ramsey, vice-president in charge of operations, was elected executive vice-president. Edwin J. Schwanhausser, vice-president in charge of the corporation's manufacturing and sales operations in Buffalo, was elected vice-president in charge of sales. Leslie C. Ricketts, manager of the corporation's Harrison Works, was also elected a vice-president.

Clarence E. Searle, New President of Worthington Pump & Machinery Corpn.

Optimus Detergents Co. has been organized at Matawan, N. J., for the purpose of manufacturing industrial detergents and developing new cleaning methods for industrial use. The new company is associated with the Optimus Equipment Co., which makes specialized cleaning equipment.

Charles C. Bray has been appointed assistant to the manager of the Worm Gear Division of the De Laval Steam Turbine Co., Trenton, N. J. He was

Hobart C. Ramsey, Executive Vice-president of Worthington Pump & Machinery Corpn.


HOW TO GET
THREAD MILLING
CUTTERS
Faster
SHELL TYPE
SHANK TYPE
Order by
STOCK BLANK
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giving Pitch and Thread Form desired
DETROIT
STANDARD STOCK BLANKS
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THREAD MILLING CUTTER
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STAMPS
DETROIT
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8432 BUTLER
DETROIT 11
MICH. U.S.A.

formerly metallurgist for the special steel department of the Philadelphia office of Joseph T. Ryerson & Son, but prior to that, was for ten years with the De Laval organization as worm-gear sales engineer in the Chicago office.

CHARLES E. SCHOLL has been appointed general sales manager of the Federal Electric Products Co., Inc., Newark, N. J. Through an error, it was mentioned in January MACHINERY that Mr. Scholl had been appointed general manager.

E. H. FARRELL has been made sales manager of the Hasco Machinery Co., 671 Frelinghuysen Ave., Newark, N. J. Mr. Farrell has been with the War Production Board, Machine Tool Division, since 1942.

New York

H. F. HENRIQUES, formerly sales manager of the North Central Division of Air Reduction, 60 E. 42nd St., New York 17, N. Y., has been appointed general sales manager. J. J. LINCOLN, previously sales manager of the South Central Division, becomes director of sales services. C. M. BLOODGOOD, who has been serving as sales manager of the Pacific Coast Division, has been made assistant to the vice-president in charge of sales. These men will all be located at the main office of the company in New York. H. P. ETTER, heretofore manager of the Los Angeles district, has been appointed sales manager of the Pacific Coast Division, with headquarters in the Mills Tower Bldg., San Francisco, Calif.

DR. W. D. COOLIDGE, since 1940 vice-president of the General Electric Co. and director of the company's research laboratory, has retired from that position. DR. C. G. SUITS, who has been assistant to the director of the research laboratory, has been elected a vice-president, and in that capacity will be in charge of the company's research laboratory. He is one of the youngest of the country's prominent scientists. He graduated from the University of Wisconsin in 1927, and became a member of the General Electric laboratory staff in 1930.

DR. R. C. BENNER, director of research for the Carborundum Co., Niagara Falls, N. Y., for the last eighteen years, retired on January 1. Dr. Benner was graduated from the University of Minnesota in Engineering in 1902, later taking his Ph.D. at the University of Wisconsin. During his business experience of forty years, he has been a patent attorney and a registered engineer, as well as an inventor, holding more than 250 patents. After taking a brief rest at his home at 460 College Ave., Niagara Falls, N. Y., he intends to do consulting research work.

LeRoy A. Petersen, Newly Elected President of the Otis Elevator Co.

LEROY A. PETERSEN, executive vice-president of the Otis Elevator Co., New York City, has been elected president of the organization to succeed Jesse H. Van Alstyne, who died recently. Mr. Petersen has been with the Otis organization since 1921, serving in various sales and executive capacities, including vice-president in charge of industrial sales. He was made executive vice-president in April, 1943.

DOEHLER DIE CASTING CO., New York, N. Y., and W. B. JARVIS CO., Grand Rapids, Mich., have been consolidated under the name of DOEHLER-JARVIS CORPORATION, with executive offices at 386 Fourth Ave., New York 16, N. Y. The plants heretofore operated by the two companies will be known as the Doehler Die Casting Division and the Jarvis Division of the Doehler-Jarvis Corporation. There will be no change in the personnel or locations of the plants.

DAVID C. PRINCE, vice-president of the General Electric Co., Schenectady, N. Y., has been placed in charge of the company's general engineering laboratory, the activities of which will be broadened to include the requirements of the entire company. He was previously in charge of application engineering for the apparatus department, and also has served as chairman of the company's special planning committee.

HARDINGE BROTHERS, INC., Elmira, N. Y., announce that the New York City office, formerly operated as HARDINGE SALES CO., 269 Lafayette St., became a factory branch on January 1. The branch will continue under the management of FRANK SUESS, who has been the Hardinge representative in New York City for the last thirty years.

CORNELIUSSEN & STAKGOLD, INC., 101 W. 31st St., New York 1, N. Y., who are acting as representatives for American manufacturers engaged in the export trade of automotive parts, machinery, steel products, and scientific equipment, are celebrating this year their twenty-fifth anniversary in this business.

C. F. PATTERSON has joined the field engineering staff of the Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y. He will serve as field engineer in Michigan. JOHN A. OWEN has also become associated with the organization, serving as field engineer in North Carolina.

HEYMAN CO., formerly at 145 Hudson St., New York City, is now being conducted as the M.V.M. Co., 109 W. 26th St., New York 1, N. Y. M. D. Heyman, president of the Heyman Co., will devote himself to further research in the development of automatic machines, featuring safety and production.

F. H. HIRSCHLAND was elected chairman of the board of the Metal and Thermit Corporation, 120 Broadway, New York City, and FRANK J. O'BRIEN was elected president at a recent meeting of the board of directors.

W. S. O'CONNOR has been appointed district sales manager of the United States Gauge Co., Sellersville, Pa., with offices in the Woolworth Bldg., 233 Broadway, New York City.

FRANK M. BATES, INC., industrial consultant, has opened new offices at 41 E. 42nd St., New York 17, N. Y.

Ohio

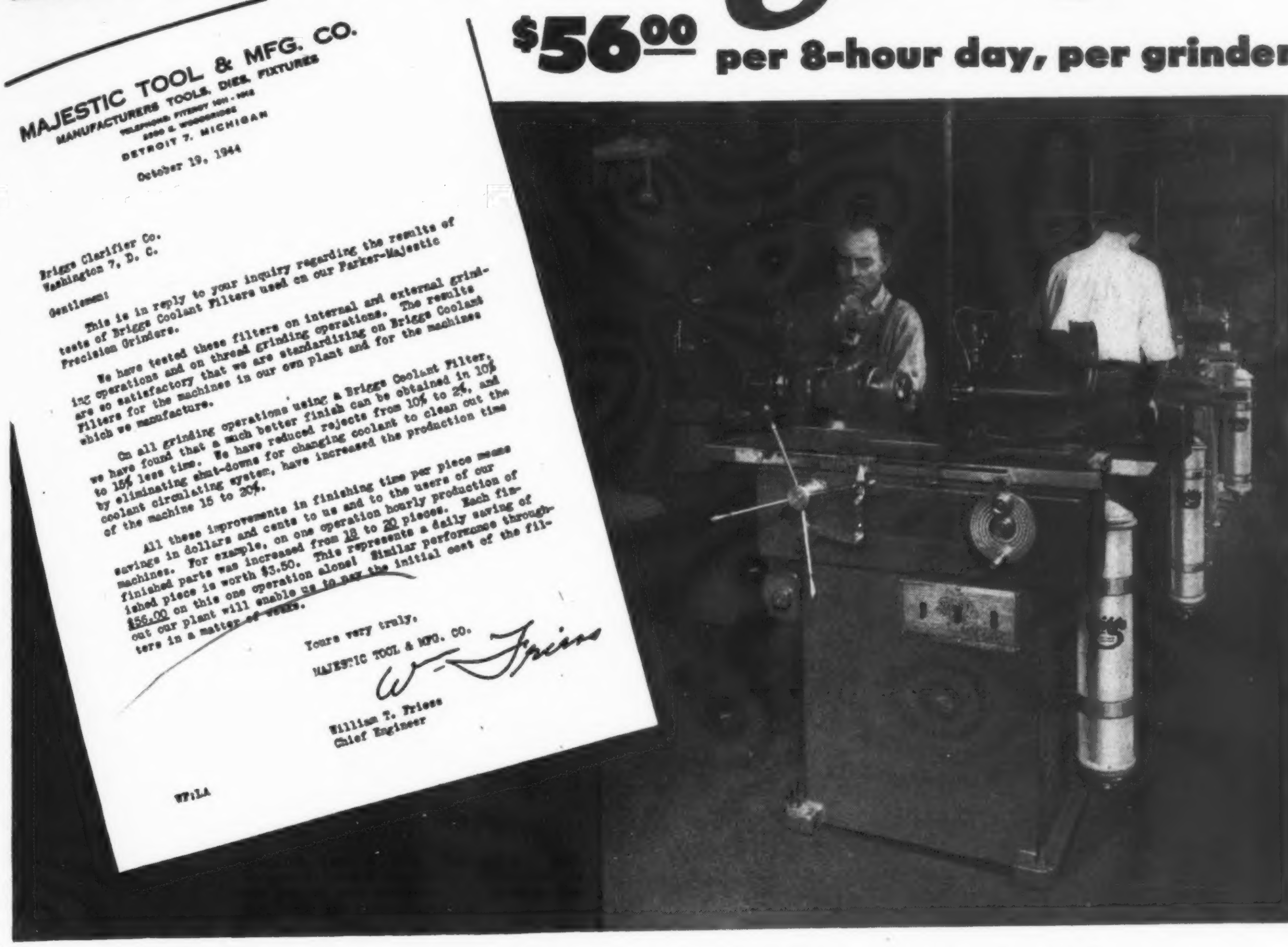
N. M. SALKOVER, for the last twenty years vice-president and general manager of the Queen City Steel Treating Co., Cincinnati, Ohio, and also vice-president of the Cincinnati Mine Machinery Co., has disposed of his interests in these organizations and is now devoting himself to Salkover Metal Processing, a company which he organized in 1941 and which specializes in commercial electric furnace copper brazing and bright annealing. The Chicago and Long Island City plants of the latter organization will be directed from offices in the Dixie Terminal Bldg., Cincinnati, Ohio.

LAKE SHORE ENGINEERING CO., Iron Mountain, Mich., announces the opening of new sales offices in the Union Commerce Bldg., Cleveland 14, Ohio. J. M. RECORD will be district manager of the Cleveland territory.

ROBERT B. NUCKOLS, who resigned last July as sales manager of the Standard Tool Co., Cleveland, Ohio, is now operating as a manufacturers' representative in southern Ohio, with headquarters in Dayton.

BRIGGS FILTERS *Earn*

$56.00 per 8-hour day, per grinder



These results, determined in the plant of Majestic Tool & Mfg. Co., prompted the management to include Briggs Filters as standard equipment on all the grinding machines they manufacture

Wm. T. Friess, Chief Engineer of the Majestic Tool & Mfg. Co., attributes these extra earnings to the fact that Briggs Filters do a superior job of coolant filtration. Better finish is obtained in less time, coolant is changed only when it becomes rancid . . . coolant lines do not clog.

Investigate Briggs Filters today if you would like to increase the output of your grinders, honing and lapping machines, lathes. There is a Briggs distributor in your locality. Call him and let him tell you WHY and HOW Briggs can accomplish such results—or write manufacturer for literature.

Briggs

PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY—*General Offices:* WASHINGTON 7, D. C.

E. Reiniger, of Washington, D. C., Office of Cincinnati Milling and Grinding Machines, Inc.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, manufacturer of milling, broaching, and cutter sharpening machines, and CINCINNATI GRINDERS INCORPORATED, manufacturer of grinding and lapping machines, announce that sales in the Baltimore and Washington, D. C., territories are now being handled by their sales subsidiary, CINCINNATI MILLING AND GRINDING MACHINES, INC., Washington Bldg., 15th and New York Ave. N.W., Washington, D. C. These sales have been handled since 1929 by CLARENCE A. THUMM, who is now retiring from active agency business. E. REINIGER, factory specialist, will be associated with C. W. BURGESS in the Washington office. Mr. Reiniger will continue to serve as factory specialist in the territory of the W. E. Shipley Machinery Co. in Philadelphia.

Harris & Ewing

C. W. Burgess, of Washington, D. C., Office of Cincinnati Milling and Grinding Machines, Inc.

Pennsylvania

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces the promotion of four men in the Dunkirk, N. Y., plant of the company. STANLEY SZACIK has been made assistant superintendent of the company's cold-drawn department, succeeding ARTHUR S. HANKS, who was recently appointed superintendent. ANTHONY PASSAFARO, formerly superintendent of hot mills at the Brigham Road plant, has been made superintendent of hot rolling mills and hammers at both the Howard Ave. and Brigham Road plants. EMIL H. FORSSTROM, previously foreman of the finishing department of the Brigham Road plant, has been made assistant superintendent of that plant. WILLIAM K. POWERS, formerly night supervisor at the Brigham Road plant, has been appointed assistant superintendent of the hot rolling mills at that plant.

JAMES C. HARTLEY has been appointed director of research of the Heppenstall Co. The research laboratories are located at the company's plant in Pittsburgh, Pa. Mr. Hartley graduated from the Brooklyn Polytechnic Institute in 1928. He was then with the American Aeronautical Corporation and later with the Crucible Steel Co. of America. Some years ago he opened his own metallurgical consulting office in New York City. He has also been chief metallurgist for Aluminum Forgings, Inc.

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., recently purchased the electric welded tube plant at Oil City, Pa., owned by TALON, INC. The new acquisition will be known as the ELECTRIC WELD TUBE DIVISION of JONES & LAUGHLIN STEEL CORPORATION, and will be operated with the present personnel.

KENNAMETAL INC., Latrobe, Pa., manufacturer of cemented carbides, tools, milling cutters, files, and wear-resistant specialties, announces that it has recently completed and is now occupying a new office building, which provides increased facilities for the company's engineering and research departments.

H. E. PRESTON has been elected vice-president in charge of engineering of the American Engineering Co., Philadelphia, Pa., which company has recently consolidated all of its varied engineering functions into one engineering department.

A. R. STARGARDTER has been appointed chief metallurgist of the Ajax Electric Co., Philadelphia, Pa., manufacturer of immersed-electrode salt-bath furnaces. Mr. Stargardter's former affiliation was with the Eastern Stainless Steel Corporation, Baltimore, Md., as chief metallurgist.

ROBERT B. THOMSON has been appointed tool engineer by Kennametal Inc., Latrobe, Pa. He will serve as assistant to the chief engineer, and will be responsible for sub-contracting. Mr. Thomson was previously assistant to the superintendent of fabrication with the Douglas Aircraft Co.

THOMAS F. DORSEY, for the last ten years sales manager of the Fort Pitt Steel Casting Co., is now associated with the Pittsburgh Steel Foundry Corporation, Glassport, Pa.

ANDREW D. PALMER has been appointed assistant manager of general advertising in the Public Relations Department, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

FOX MUNITIONS CORPORATION, 21st and Arch Sts., Philadelphia 3, Pa., has changed the name of the company to FOX INDUSTRIES, INC.

Wisconsin

RAE F. BELL, former first vice-president of the A. O. Smith Corporation, Milwaukee, Wis., has been elected chairman of the board of directors, to succeed the late L. R. Smith. Mr. Bell has been with the organization since 1923, first as vice-president and later as first vice-president.

* * *

Foundrymen Cancel Convention

The American Foundrymen's Association, 222 W. Adams St., Chicago, Ill., has announced that the War Production Foundry Congress, scheduled to be held in Detroit April 30 to May 4, has been cancelled, although the meeting was to have been devoted exclusively to the presentation of technical papers and reports bearing upon the production of castings for war purposes. The officers of the Association voted to cancel the scheduled meeting in order to save pressure on transportation and hotel facilities.

* * *

Shell Manufacturer Receives Army-Navy Award

In view of the relatively small number of war contractors making shells who have received the Army-Navy E Award, it is of interest to know that the Hosdreg Co. has just received the fourth star for its Army-Navy flag.

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INSPECTION PROCEDURE FOR ELECTRIC FURNACES—1

Things to Inspect for Each Shift

What to Inspect	What to Inspect for
Control instruments	Correct temperature settings for material to be heated. Make visual check of proper functioning of mechanical parts and pointers, and electric devices.
Thermo-couples	Make sure they are in operating condition and also that they are in proper location for the work being treated.
General control	Check signal and electronic devices. Clean sight glasses for photo-electric control (electric eyes) and radiation thermo-couples.
Doors	Check to see that doors fit properly to prevent excessive loss of heat or furnace atmosphere.
Cooling water	Test water temperature, and make visual checks of flow at discharge.
Gas atmosphere	Check flow. Check analysis.
Quench and coolers	Check temperature and flow of coolant.
Bearings	Check temperature. Check for excessive vibration. Check water flow on water-cooled bearings.
Interior metal parts—hearth plates, conveyors, supports, etc.	Make sure alloy castings are in proper location. Check for presence of excessive warping.

MACHINERY'S Data Sheet No. 531, February, 1945

Compiled by the General Electric Co.
Schenectady, N. Y.

INSPECTION PROCEDURE FOR ELECTRIC FURNACES—2

Things to Inspect Every Week

What to Inspect	What to Inspect for
Heating unit terminals	Check for evidence of overheating. Check connections to make sure they are tight.
Stuffing-boxes	See that they are gas-tight.
Heating units	Check for evidence of "hot spots," warping, and position of supports.
Thermo-couples and control instruments	Check thermo-couple condition for excessive oxidation or breakage. Check accuracy of thermo-couple by means of an optical unit or additional thermo-couple.
Mechanisms—conveyors, roll drives, pushers, drive belts, chains, etc.	Make general inspection for proper functioning.
Circulating pumps	Check for excessive vibration. Check pressure and flow. Check packing for evidence of leaks.
Contactors	Check packing for evidence of leaks.

MACHINERY'S Data Sheet No. 532, February, 1945

Compiled by the General Electric Co.
Schenectady, N. Y.

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Obituaries

Don R. Marsh

Don R. Marsh, factory manager of the Buffalo Forge Co., Buffalo, N. Y., died suddenly at his home in Buffalo on December 21 at the age of sixty-three years. Mr. Marsh was born on November 25, 1881, at Sacramento, Calif. Shortly after that date, the family moved to Massillon, Ohio, where Mr. Marsh grew up and was educated. In February, 1910, he went to work as a cost accountant for the Buffalo Forge Co. Successively, he was head of the cost department, production manager, and factory manager. He was elected director of the company in 1930, and was also a director of the Canadian Blower & Forge Co., Ltd., of Kitchener, Ontario.

Mr. Marsh was deeply interested in the human side of the company's management, and was highly regarded by all the employes. He took an active interest in all employe activities, and was always accessible for conference with anyone in the plant. During the last four years, he put great personal effort into the company's war work. He is survived by his wife, a son, and a daughter.

Walter H. Emrick

Walter H. Emrick, vice-president and director of the Ettco Tool Co., Inc., Brooklyn, N. Y., died on Thursday, January 11, of a heart attack, at the age of thirty-five years. Mr. Emrick was born in Brooklyn and came into the employ of the Eastern Tube & Tool Co., predecessor of the Ettco Tool Co., in 1925. While working, he continued his engineering studies and graduated from the Pratt Institute in Brooklyn.

After completing his apprenticeship in the factory, he became, successively, machine operator, toolmaker, and shop superintendent. Later, he took over the distribution and sales development of the company's line of tools, in which work his thorough knowledge of the manufacture of the company's products became of great value to him and to the organization. Later, he became vice-president and a director of the Ettco Tool Co., which had been formed in 1929.

At the time of his death, he was engaged in engineering work in Frostburg, Md. He was taken ill suddenly while there. His loss is keenly felt by his associates and by those who knew him in his business activities. He is survived by his father, George W. Emrick, who is president of the Ettco Tool Co., and by two brothers, Robert and Melvin, who are also associated with the company.

A. P. Steiner, formerly chief engineer and superintendent of the Landis Tool Co., Waynesboro, Pa., died on January 8. Mr. Steiner was born in Bluffton, Ohio, in 1873. He became connected with the Landis Tool Co. in 1899 and had been with the company ever since. During the last few years he had acted in the capacity of consulting engineer. Mr. Steiner held forty United States patents and a number of foreign patents. He was a pioneer in the application of hydraulics to machine tools. His son, J. S. Steiner, who survives him, is plant manager of the Landis Tool Co.

L. C. Kenyon, manager of the New York office of the Heald Machine Co., Worcester, Mass., died of a heart attack at his home in Summit, N. J. on January 9, aged fifty-seven years. Mr. Kenyon was born at Hope Valley, R. I., on June 7, 1887. He graduated from Brown University in 1915, and in 1918 became connected with the Heald Machine Co. in Worcester. At the time of his death, he had just completed his twenty-fifth year as manager of the New York branch office of the company. He is survived by his widow and his mother.

Charles S. Trott, assistant treasurer and sales manager of the Parker-Kalon Corporation, 200 Varick St., New York City, died on December 19 at the age of forty-five. Mr. Trott had been connected with the company and its predecessors for twenty-nine years, and directed the sales and advertising departments for twenty-two years.

* * *

The first completely roller-bearing equipped steam locomotive was built in 1929. It is still employed in passenger transportation, and has a record of about 850,000 miles of service. Nearly all of the original roller bearings are still in use on the engine.

Coming Events

February 8-9—Meeting of the American Society of Lubrication Engineers at the Hotel Stevens, Chicago, Ill. For further information, address the Society at its headquarters, 135 S. LaSalle St., Chicago.

April 4-6—National Aeronautic Meeting of the Society of Automotive Engineers at the Hotel New Yorker, New York City. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

April 16-18—Spring meeting of the American Society of Mechanical Engineers in Boston, Mass. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

June 17-21—Semi-annual meeting of the American Society of Mechanical Engineers in Chicago, Ill. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

June 18-22 — Forty-eighth annual meeting of the American Society for Testing Materials at the Hotel Statler, Buffalo, N. Y. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia 2, Pa.

October 1-3 — Fall meeting of the American Society of Mechanical Engineers in Cincinnati, Ohio. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

* * *

What Individual Enterprise Can Accomplish

In a publication *Adventures in Business*, published in Los Angeles, Calif., the story of Wade E. Miller is recorded. In 1937, Mr. Miller was a young man of twenty-eight years—just one of the many thousands of workers on the assembly line of a large aircraft plant. Today, he is the owner and president of a successful, prosperous, special tool equipment company, employing hundreds of people and with representation throughout the United States and in five foreign countries.

His success was not built by either pull or inherited money. Realizing that better tools could turn out a better job, and that there was a market for such tools, he borrowed $200 to buy a lathe, and worked day and night in his little garage workshop to develop his designs and to fill his orders. In the short space of seven years, he has built a large prosperous business. Who said that there are no opportunities any more for young men in these United States?

New Books and Publications

MACHINERY'S GEAR DESIGN HANDBOOK. By W. A. Tuplin. 74 pages, 7 1/2 by 9 3/4 inches. Published by the Machinery Publishing Co., Ltd., 17 Marine Parade, Brighton 1, England. Price, 12/6d.

This book has been brought out principally for the man who wants to learn with the least amount of study how to deal with the common problems of gear design. With this end in view, an attempt has been made to present simple and reliable rules for the gear designer. The information given is derived from long experience. It presupposes familiarity with engineering drawings and the ability to evaluate simple algebraic and trigonometrical expressions. Examples are given in order to make clear just how the rules are applied in solving typical problems.

The data given applies primarily to British tooth forms and practice. It has reference to involute gears, the teeth of which are generated by cutters of 20-degree normal pressure angle and which have a working depth of not less than 0.636 times the normal pitch. Some of the formulas, as, for example, those for load capacity, may be used with properly modified constants for gears of other pressure angles. The information given also applies to gears that are not cut by the generating processes, provided they have the normal degree of accuracy obtained in generated gears of the same nominal dimensions and have the tooth form generated by British standard cutters in blanks of the diameters specified.

Guidance is given in the selection of materials and general dimensions of gears for any particular duty, followed by details of the methods of determining the dimensions required when drawing and making the gears.

ARC-WELDING ENGINEERING AND PRODUCTION CONTROL. By Walter J. Brooking. 347 pages, 5 1/2 by 8 1/2 inches; 227 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.

Much valuable information is available for the elementary training of welding operators. Descriptions of welding processes and equipment are plentiful. This book, however, deals with control of arc-welded production, and is intended to serve as a link between the more elementary literature and the highly technical reports of research engineers. Thus, the production foreman, the welding engineer who seeks additional information, the welding instructor who is trying to broaden his knowledge, and the organization just converted to welded production should be aided by this book.

Briefly, the book covers such subjects as what arc-welding specifications should show; economical benefits from engineering control; material control; arc-welding costs; control of equipment; jigs and fixtures for arc-welding; inspection in mass production plants; the machining of arc-welded products; the training of operators; and arc-welding equipment.

PROCESS EQUIPMENT DESIGN. By Herman C. Hesse and J. Henry Rushton. 580 pages, 6 by 9 inches; profusely illustrated. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. Price, $7.50.

This book presents the fundamentals of mechanics, machine and structural elements, and economic and manufacturing considerations related to the design of equipment for the chemical industries. The book is based upon five years of lecture and laboratory work with senior engineering students, and is adaptable to advanced classes familiar with industrial process design, with physical metallurgy, and with the unit operations of chemical engineering. Ease and economy of fabrication and protection against chemical or corrosive action have been emphasized as of major importance in design and in the selection of materials.

The book deals with such subjects as materials of construction; mechanical properties and strength of materials; riveted and welded pressure vessels; threaded fasteners; trusses; piping; ferrous, non-ferrous, concrete, and wood construction; belt and chain drives; gearing; shafting and bearings; and handling equipment.

PRODUCTION LINE TECHNIQUE. By Richard Muther. 320 pages, 6 by 9 inches; numerous illustrations. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $3.50.

This book covers in a comprehensive, yet easily assimilated, manner the principles of line production. It is divided into four main parts: Line Production—Its Advantages and Limitations; Establishing the Line; Operating the Line; and Diversification in Line Production. Under these main headings, such subjects as methods and equipment, movement of material, lay-out of plant, installation, organization and planning, materials control, production control, quality control, maintenance, and personnel are dealt with. Modifications of line production, as, for example, progressive machine groupings, are also dealt with.

CARE AND USE OF TOOLS. By Raymond R. Toliver. 93 pages, 5 1/2 inches by 8 1/2 inches; 70 illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $1.25.

Much of the material in this book was prepared originally for the training of beginners in an airplane plant. It was written with reference to actual shop operations and designed to help new employes to become useful quickly in the organization. Later, the entire book was rewritten in a more general form, in order to make it useful to industrial training classes and shop classes in high schools and manual training institutions. It deals with vises, hammers, cold chisels, files, screwdrivers, hacksaws, pliers and nippers, wrenches, threading taps, drills, reamers, and measuring tools, including micrometers.

SHEET METAL THEORY AND PRACTICE. By John C. Butler. 173 pages, 8 1/2 by 11 inches; 152 illustrations. Published by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. Price, $3.

This book contains the material prepared for a training program to meet the need for trained men in the sheet metal shop of a large West Coast Navy Yard. It is now made available to anyone interested in marine sheet metal work, either as a worker or as an instructor. Most of the material is applicable to all branches of sheet metal work. Briefly, the book covers tools and machines, welded and riveted assemblies, soldering and fluxes, seams and locks, blueprint reading, measuring, templeting, use of paper patterns, material allowances, shop arrangement, and materials, together with a section on ship terms.

WHAT IS VOCATIONAL EDUCATION? By George H. Fern. 159 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Chicago, Ill. Price, $2.50.

The author of this book is Director of the Michigan State Board of Control for Vocational Education, and State Director of Vocational Training for War Production Workers. The book aims to set forth the philosophy, purpose, operating plans, and accomplishments of vocational education. It will help vocational educators to clarify their own thinking, re-evaluate their aims, and aid them in planning for the future of vocational education.

FIRE SAFETY EDUCATION FOR EMPLOYES. 6 pages, 6 by 9 inches. Published by the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. Price, 10 cents.

Classified Contents of This Number

Put SPEEDAIRE into your Picture for 1945

PICTURE the new Cleveland Speedaire Worm Gear Units on your equipment, and you picture new low costs for transmitting your power. Because Speedaire creates an entirely new standard of worm gear performance—and gives you *more horsepower for your dollar.*

Make *your* conversion effective, by applying Speedaire on all of the equipment you purchase next year. Speedaire is as modern as the newest machine you will install—as trustworthy as everything Cleveland has built for you since 1912.

We'll gladly send literature—or a District Representative. The Cleveland Worm & Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate:—The Farval Corporation, Centrailzed Systems of Lubrication
In Canada: PEACOCK BROTHERS LIMITED

SPEEDAIRE
Pointers for your Design Engineer:—

1—Speedaire—the *new* Fan-Cooled Worm Gear Reduction Unit—continually removes heat by means of a high-velocity air stream scouring the surfaces of the oil reservoir.

2—Because Speedaire *stays* cool, it delivers up to twice the capacity of standard worm units of equal frame size, at usual motor speeds.

3—Speedaire can be installed economically on many applications where other types have been used heretofore —giving you the advantages of a compact right-angle Drive.

4—Furnished in 6 standard sizes—from 3 to 95 H.P.

5—Speedaire incorporates design and construction fundamentals inherent in all Cleveland Worm Gear Units for more than 30 years.

SPEEDAIRE
FAN COOLED